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ABSTRACT

Presenting diagnostic teaching units for grade 7 science and Science 14, this handbook is intended to be used along with the companion handbook 1, "Evaluating Students' Learning and Communication Processes: Integrating Diagnostic Evaluation and Instruction." The student activities of the diagnostic teaching units in the handbook have been designed to engage students in the six learning and communication processes (exploring, narrating, imagining, empathizing, abstracting, and monitoring) described in the companion handbook. The handbook consists of two diagnostic teaching units: grade 7 science, "Structures and Design" and Science 14, "Household Science: Acids and Bases." Each unit includes a general description of the lessons in the unit followed by more detailed plans for each lesson. The final section of the unit contains supplementary materials created to support the lessons in the unit. (RS)

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EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES

DIAGNOSTIC TEACHING UNITS: SCIENCE

This document was written primarily for:

Students	
Teachers	✓
Administrators	
Parents	
General Public	
Others (Specify)	

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Introduction

Purpose of This Handbook

Integrating diagnostic evaluation with instruction in science

The diagnostic teaching units in this program have been designed to help you include diagnostic evaluation of students' learning and communication processes with regular learning activities in your classroom. This handbook, which presents diagnostic teaching units for Grade 7 Science and Science 14, is intended to be used along with Handbook 1, *Evaluating Students' Learning and Communication Processes: Integrating Diagnostic Evaluation and Instruction*. This companion handbook explains the theoretical framework of the program and describes the evaluation and instructional strategies that will help you and your students gain the most benefit from your use of the diagnostic teaching unit.

The student activities of the diagnostic teaching units have been designed to engage students in the six learning and communication processes described in Handbook 1 of the program so that their independent use of these processes can be assessed. Your students will have opportunities to observe and evaluate their own learning and communication processes and those of their peers. You and your students will be able to construct profiles of their independent use of the processes. You can use these profiles cooperatively to plan instructional activities that will help your students develop greater independent control over their learning and communication processes.

These units are not intended to prescribe content or methodology. You may wish to use the units exactly as presented, or you may wish to adapt the learning activities to fit your own situation and your own students. We hope you will view the diagnostic teaching units as models that can be replicated for other topics in the courses you are teaching. In this way, you can continue to gather diagnostic information about your students' learning and communication processes and meet their individual needs as learners and communicators.

Structure of This Handbook

The Diagnostic Teaching Units

This handbook consists of two Diagnostic Teaching Units:

Grade 7 Science, "Structures and Design"

Science 14, "Household Science: Acids and Bases"

Each unit includes a general description of the lessons in the unit followed by more detailed plans for each lesson. The final section of the unit contains supplementary materials created to support the lessons in the diagnostic teaching unit.

The Diagnostic Teaching Unit

Structure of the Diagnostic Teaching Unit

The diagnostic teaching unit has three parts—Unit Plan, Lesson Plans, and Student Materials.

The Unit Plan

The Unit Plan presents a general overview of the unit. These planning sheets are facing pages divided into several columns. (See pages 12 and 13 for an example.)

Processes
-Exploring
-Narrating
-Imagining
-Empathizing
-Abstracting
-Monitoring

The first column, "Processes," indicates the six learning and communication processes students will use as they participate in the activities—Exploring, Narrating, Imagining, Empathizing, Abstracting, and Monitoring. Titles of the lessons are also found in this column. Under the lesson title, the processes to be emphasized during each lesson are indicated by an "x." Processes that will be used by students, but are not the prime focus of evaluation, are indicated by a check mark.

Diagnostic Evaluation Procedures

The second column, "Diagnostic Evaluation Procedures," summarizes what you will do to evaluate the learning and communication processes of selected students. Key words in these procedures are boxed for emphasis.

Activities

Classroom Organization

Strands

The third column, "Activities," indicates what you and your students will do during each lesson. The fourth and fifth columns indicate how students are organized for the lesson (learning as individuals, in pairs, in small groups, or in a whole class setting) and the language strands that are engaged in during each lesson (reading, writing and representing, oral communication—listening and speaking, and viewing).

Program Objectives

Materials

The sixth column lists the objectives from the Program of Studies that are pertinent to each lesson. The seventh and final column lists the materials students will use in the lesson and the materials that you will use to observe and evaluate their learning and communication processes.

The Lesson Plans

Like the Unit Plan sheets, the Lesson Plan sheets are divided into columns. (See page 32 for an example.)

Objectives

The first column, "Objectives," lists the knowledge, skill, and attitude objectives from the Program of Studies that are the focus of the lesson. Opportunities to engage in the six learning and communication processes will help students achieve these objectives. The Descriptive Scales and the Observation/Profile Sheets in the companion handbook, *Evaluating Students' Learning and Communication Processes: Integrating Diagnostic Evaluation and Instruction*, will enable you to evaluate students' attainment of these objectives *indirectly* and *formatively* through your evaluation of their learning and communication processes. Any *summative* evaluation procedures that you conduct during the lesson will, of course, take these objectives more directly into account.

Procedures
-Student Activity
-Teacher Activity
-Supplementary or Alternate Procedures

The "Procedures" column is subdivided into Student Activity, Teacher Activity, and Supplementary or Alternate Procedures. Descriptions and explanations of the diagnostic evaluation procedures that you will conduct, as the students are involved in activities, are highlighted with grey screening for emphasis. Under "Supplementary or Alternate Procedures" you will find additional information about the lesson or about procedures that might be necessary for your students, as well as alternate activities that you may wish to try.

Materials

The third column lists the materials that will be used during the lesson. The resources students will need and the record-keeping forms and equipment you will need are listed directly opposite the activity they apply to.

The Student Materials

Student materials have been created to support the lessons in this unit. Additional readings are included in this section, as are assignments for small group work and writing of various kinds. These student materials may be duplicated for classroom use.

Grade 7 Science
Structures and Design

An examination of the relationship between science and technology through direct experience in the design and construction of structures to solve problems

In this Diagnostic Teaching Unit, students will examine the relationship between science and technology through a study of structures and design. They will learn that the design and construction of materials involves the creative application of science and technology. Students will be involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

Lesson Summaries

There are fourteen lessons in this unit. The term "lesson" refers to a group of related activities that may require more than one class period to complete. Some may require less than one class period. You may wish to adapt the lessons according to the needs of your students and the availability of resources. A brief summary of the lessons follows.

Lesson One: "Building a Tower" introduces students to technological problem-solving and encourages them to draw upon their tacit knowledge of structure within a specified time period, using only materials provided. Students also begin a journal, using writing to reflect upon and extend the learning activity.

Lesson Two: "Designs in Natural and Manufactured Structures" introduces students to the principles of technological problem-solving. Students learn how to preview a text, noting features of the text and their purposes. They learn precise scientific definitions of key words related to structure and design. They use their journals to record what they have learned and record examples of manufactured structures that reflect natural structures in their design.

Lesson Three: "Relating Function and Design" invites students to explore the relationship between function and design by thinking of novel uses for familiar objects.

Lesson Four: "Using Similar Materials to Create Different Designs to Serve Various Functions" provides additional practise in appropriate prereading strategies and engages students in technological problem-solving, using given materials in creative ways to design structures to serve specific purposes. Students also practise making diagrams to record their observations.

Lesson Five: "Review" involves students in collaborative group work to answer questions that probe their understanding of ideas and language in the preceding lessons.

Lesson Six: "Quiz" involves students in independent work to answer questions that test their understanding of new ideas and language in previous lessons.

Lesson Seven: "Strength of Materials—Compression and Tension" provides additional practise in appropriate prereading strategies. Students are challenged to formulate hypotheses about the compressive and tensile strength of materials, design and carry out experiments to test their hypotheses, and apply their understanding of compressive and tensile strength to real-life situations requiring their use. They also practise writing to learn, beginning a series of journal entries that will encourage them to apply what they are learning to the design of an imaginary structure.

Lesson Eight: "Designing for Support and Strength" provides additional practise in appropriate prereading strategies. Students carry out tasks to learn different ways of providing support and strength to a beam.

Lesson Nine: "Testing the Shape and Strength of Beams" involves students in constructing beams of different shape; testing the strength of each; drawing tentative conclusions about the relationship between orientation, shape, and strength of beams; and then reading to verify, extend, and refine their conclusions. They also practise writing to learn, relating what they have learned about the shape and strength of beams to design of their imaginary structure, modifying it if necessary in light of new information.

Lesson Ten: "Reinforcing Structures for Strength" provides additional practise in effective reading strategies. Students learn how triangles can be used in the design of a structure to lend support and strength to the structure. They also practise writing to learn, reflecting on the application of this knowledge to the design of their imaginary structure.

Lesson Eleven: "Reinforcing Structures for Strength" provides additional practise in effective prereading strategies. Students extend their knowledge of how triangles can be used to give support and strength to a structure, examining the effect when corrugated materials are used. They also practise writing to learn, exploring the application of this knowledge to the design of their imaginary structure.

Lesson Twelve: "Testing the Shape and Strength of Columns" involves students in constructing columns of different shapes, testing their strength, drawing tentative conclusions about the relationship between strength and shape, and then reading relevant sections of their textbook to verify, extend, and refine their understanding. They also practise writing to learn, exploring the application of this knowledge to the design of their imaginary structure.

Lesson Thirteen: "Circles of Knowledge" requires students to demonstrate their ability to apply prereading strategies independently to their reading about one of five topics. Then they work in small groups on tasks related to their reading, prepare to share new ideas and language with other students, make up questions to monitor the effectiveness of their presentations, read other students' answers to their questions, and provide feedback to clarify other students' understanding if necessary. They also practise writing to learn by making an entry in their journal about this activity.

Lesson Fourteen: "Building a Better Tower" challenges students to apply their knowledge of technological problem-solving and structures and design to the construction of a tower that must be built to meet more rigorous specifications than in Lesson One. They also complete their journal with an entry similar to that of Lesson One, except that in this entry they must use the formal language of structures and design with accuracy and precision.

GRADE 7 SCIENCE

STRUCTURES AND DESIGN

Acknowledgments

Unit Developers:

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson One: Building a Tower ✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson						OBSERVATION and EVALUATION of selected students' learning and communication processes in their discussion, tower building, and writing.	1. Working individually, students make a preliminary sketch of a design that they think will meet the rules (specifications) for the tower. 2. Working in groups of three, students pool their ideas, select a design, and construct a tower within a specified time period. 3. The groups bring their towers to a test table to demonstrate that they are self-supporting. 4. The students make individual entries about this activity in their journals.
✘	✘	✘	✔	✔	✔		
Lesson Two: Designs in Natural and Manufactured Structures ✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson						OBSERVATION and EVALUATION of selected students' learning and communication processes in their reading, discussion, and journal writing.	1. Students read their journal entries for Lesson One, and through guided discussion, generate tentative generalizations about technological problem-solving. 2. Students engage in prereading activities to establish purposes for their reading of the relevant sections of their textbook. 3. Students read the information on pages 74 to 77 of the textbook. Working in groups of three, they discuss how their definitions of "structure," "design," "natural," and "manufactured" may need to be extended and refined to make them more precise, and they write down their suggested revisions. They discuss answers for questions under Probing, page 77. They discuss and prepare written answers for questions and directions under Procedure, Finding Out, and Finding Out More for Activity 2-1, pages 78 and 79. 4. As a homework assignment, students write a brief entry in their journals, recording the important things they learned in today's lesson and listing some manufactured structures they observe in their homes or neighborhoods that are similar in design to natural structures.
✘	✘	✘	✔	✔	✔		

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 4, 6 Skills: 2a, 2b, 3a, 3b, 4a, 4b Concepts: 3e, 4g To practise using writing to learn.	For each group of three students: 30 paper-clips 30 straight pins 1 spool of thread 20 plastic straws large enough in diameter to hold a paper-clip securely OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape JOURNAL ENTRY for Lesson One: Building a Tower, which is attached to the lesson plans.
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2, 3, 4, 5 Skills: 1a, 1b, 2a, 3b, 4a, 4b Concepts: 1a, 1b, 1c, 1d, 1e, 2a, 2b, 3c, 4h To practise appropriate prereading strategies. To practise using writing to learn.	Students' journal entries from Lesson One. *Science Directions*, Wiley, pages 74 to 79 OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape

* Objectives have been drawn from the Program of Studies for Junior High Science (DRAFT C.D. 90/03/19). The numbers refer to concepts, as numbered in the program of studies. Letters of the alphabet refer to specific skills listed under these concepts. The letter "a" stands for the first skill, the letter "b" for the second, and so on.

UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

<table>
<tr><th colspan="6">PROCESSES</th><th rowspan="2">DIAGNOSTIC EVALUATION PROCEDURES</th><th rowspan="2">ACTIVITIES</th></tr>
<tr><th>EXPLORING</th><th>NARRATING</th><th>IMAGINING</th><th>EMPATHIZING</th><th>ABSTRACTING</th><th>MONITORING</th></tr>
<tr><td colspan="6">Lesson Three: Relating Function and Design
✘ indicates a process emphasized in the lesson
✓ indicates a process used in the lesson</td><td rowspan="2">OBSERVATION and EVALUATION of selected student's learning and communication processes in their small group activity and writing.</td><td rowspan="2">1 Students present their answers for the exercises in Activity 2-1, pages 78 and 79. They also give examples from their journals of manufactured structures they have observed in their homes or neighborhoods that are similar in design to natural structures.
2. Students guess the possible functions of unfamiliar objects, relating their guesses to the design of the structure.
3. Working in groups of three, students complete Activity 2-4, numbers 2 and 3, taking turns selecting objects for which the other group members must devise novel functions.
4. As a homework assignment, relating this lesson to environmental concerns, students make a list in their journals of five or six objects that their family commonly discard as garbage. With the assistance of some of their family members, they list two or three functions each object could serve if it was not thrown away.</td></tr>
<tr><td>✘</td><td>✘</td><td>✘</td><td>✘</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="6">Lesson Four: Using Similar Materials to Create Different Designs to Serve Various Functions
✘ indicates a process emphasized in the lesson
✓ indicates a process used in the lesson</td><td rowspan="2">OBSERVATION and EVALUATION of selected students' learning and communication processes in their small group activity.</td><td rowspan="2">1. Students share some of their lists of novel uses for commonly discarded objects.
2. Students preview pages 88 and 89 of their text book.
3. Students suggest alternative designs to perform the function specified for Task 1.
4. Working in groups of three, students design structures to perform the functions specified for Tasks 2 to 8 and record the task, materials used, design, observations, and any problems with the design.
5. Students then answer questions 1, 2, and 4 under Finding Out and question 5 under Extension.
6. Students share their designs for structures and their answers to questions assigned.</td></tr>
<tr><td>✘</td><td>✘</td><td>✘</td><td>✘</td><td>✘</td><td>✘</td></tr>
</table>

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2 Concepts: 1d, 2a, 2b, 3c, 5c To practise using writing to learn.	Activity 2-1 in *Science Directions*, Wiley, pages 78 and 79. Students' journals Several objects that are likely to be unfamiliar to students, such as: melon scoop meatball maker honey stirrer staple remover tuning fork Activity 2-4 in *Science Directions*, Wiley, page 86.
		✓	✓	✓	✓	✓	✓	Attitudes: 1, 4, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b Concepts: 3c, 3d, 3e To practise appropriate prereading strategies	Students' journals Activity 2-5 in *Science Directions*, Wiley, pages 88 and 89. (See page 88 for other materials required for this activity.) **OBSERVATION/PROFILE sheet designed for use with groups.** **Tape recorder** **Video camera** **Audiotape** **Videotape**

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES	EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING	DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
Lesson Five: Review ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson	✓	✓	✗	✗	✗	✗	OBSERVATION and EVALUATION of selected students' learning and communication processes in their small group discussion, writing, and drawing.	1. Working in groups of three, students discuss and answer review questions based on previous lessons. 2. Students share their answers to review questions. 3. Students evaluate their performance in the small group discussion of answers to review questions.
Lesson Six: Quiz ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson							OBSERVATION and EVALUATION of selected students' learning and communication processes in their writing. Student SELF-EVALUATION and PEER EVALUATION of learning and communication process in their work during Lessons One to Six: tower building, reading, journal writing, small group activity, small group discussion, and drawing. CONFERNECING with individual students to share observations and evaluations of their learning and communication processes.	1. Working independently, students prepare written answers for questions under What's the Purpose?, Finding Out, and Finding Out More, pages 90 and 91.

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2, 4, 5 Skills: 1a, 1b, 2a, 2b, 4a Concepts: 1a, 1d, 1e, 2a, 2b, 3c, 3d To practise self-evaluation of collaborative learning skills.	Checkpoint in *Science Directions*, Wiley, page 92. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape Group Evaluation Form in the Teacher Resource Package, Wiley, page 1-18.
✓				✓	✓	✓	✓	Attitudes: 1, 2, 4 Skills: 1a, 1b Concepts: 1d, 2a, 2b, 3a, 3c, 3d, 3e	Activity 2-6 in *Science Directions*, Wiley, pages 90 and 91.

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Seven: Strength of Materials—Compression and Tension ✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson						OBSERVATION and EVALUATION of selected students' learning and communication processes in their reading, small group activity, and writing.	1. To acquire background knowledge for designing and carrying out their own experiments to test compressive and tensile strength of materials, the students read Topic Three—Materials Matter, pages 93 to 101 of their textbook. 2. Working in groups of three, students design and carry out experiments to test the compressive and tensile strength of materials provided. They also prepare written responses to questions and directions provided. 3. To the class, students report their hypotheses, the procedures used to test their hypotheses, their rankings of the compressive and tensile strength of the materials tested, and their examples of situations requiring the use of materials that have a high compressive or a high tensile strength. 4. As a homework assignment, students apply concepts from their reading and experiments in an individual journal entry, in which they explore possibilities for a structure they would like to design for their own use or for an imaginary teenager
✘	✘	✘	✔	✔	✔		
Lesson Eight: Designing for Support and Strength ✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson						OBSERVATION and EVALUATION of selected students' learning and communication process in their small group activity, writing, and sketches.	1. Students recall and summarize the experiments they conducted in the previous lesson. 2. Students respond to one another's journal entries. 3. Students preview the relevant parts of their textbook to establish the problem and the nature of the task they will be undertaking. 4. Working in groups of three, students clarify the task for themselves, follow directions, make sketches where appropriate, and discuss and prepare written answers for questions under Finding Out and Finding Out More on page 103. 5. Students share their answers to questions with the rest of the class. 6. Students skim the text to locate particular details. 7. Students categorize their suggestions for preventing a beam from bending or breaking.
✘	✘	✘	✔	✔	✔		

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1a, 1b Concepts: 2b, 3d, 3e, 4a, 4b, 4c, 4d, 4e, 5a, 5b, 5c To practise appropriate prereading and postreading strategies. To practise using writing to learn.	Topic Three—Materials Matter in *Science Directions*, Wiley, pages 93 to 101. TESTING THE STRENGTH OF MATERIALS, which is attached to the lesson plans. (Specific materials needed for this activity are listed on the handout.) OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape JOURNAL WRITING ASSIGNMENT for Lesson Seven: Strength of Materials, which is attached to the lesson plans.
		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 1b, 2a, 4a Concepts: 2a, 2b, 3b, 3c, 3d, 3e, 4c, 4d, 4e, 4f, 4g, 5a, 5b, 5c To practise appropriate prereading strategies. To practise skimming a text to locate particular details.	Students' journals Activity 2-10 in *Science Directions*, Wiley, pages 102 and 103. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape Bending and Breaking in *Science Directions*, Wiley, page 104.

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Nine: Testing the Shape and Strength of Beams						OBSERVATION and EVALUATION of selected students' learning and communication processes in their small group activity and journal writing.	1. Students recall methods for preventing a beam from bending or breaking. 2. Working in groups of four, students preview, clarify, and carry out the tasks, recording observations as directed. 3. Students report and compare their observations with those of other groups. They draw tentative conclusions about the relationship among orientation, shape, and strength of beams. They explore possible reasons for differences in their observations. 4. Students preview and read pages 108 and 109 of their textbook for confirmation of their conclusions, for additional information to extend and refine their understanding, and for illustrations of the practical application of this knowledge. 5. As a homework assignment, students review the preliminary design they created at the end of Lesson Seven for a structure of their choice, and note in their journal any modifications they would make to the original design as a consequence of what they have learned about **the orientation, shape, and strength of beams**. (Some students may find that they have used these principles intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principles explored in this lesson. They should explain why this is so.)
✘ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson							
✘	✘	✓	✓	✓	✓		

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 4 Skill: 1a, 1b, 2a, 3a, 4a Concepts: 1a, 1b, 2a, 2b, 3b, 4a To practise appropriate prereading strategies. To practise using writing to learn.	SHAPE AND STRENGTH, PART A, which is attached to the lesson plans. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Ten: Reinforcing Structures for Strength						OBSERVATION and EVALUATION of selected students' learning and communication processes in their small group activity and journal writing.	1. Students recall principles regarding the relationship amoung orientation, shape, and strength of beams. 2. Students explain any changes made in their preliminary design for a structure in order to apply these principles, or they explain where their original design already included these principles. 3. Students examine illustrations in the textbook, identify the use of triangles in the design of different structures, and describe the function of this component of the design. 4. Students skim the text to locate particular details. 5. Working in groups of three, students preview, clarify, and carry out the tasks in Activity 2-13 on page 112. 6. Students display and demonstrate the frames they have constructed. They explain how they have used triangles to make the frames more rigid. 7. As a homework assignment, students review the preliminary design they have created for a structure of their choice and note in their journals any modifications they would make to the original design because of what they have learned about the use of **triangles** to provide support and strength to a structure. (Some students may find that they have used this principle intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principles explored in this lesson. They should explain why this is so.)
✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson							
✗	✗	✓	✓	✓	✓		

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS					
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING	**PROGRAM OBJECTIVES***	**MATERIALS**
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 3, 4, 5, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a Concepts: 1a, 1c, 1d, 1e, 2a, 2b, 3a, 3b, 3c, 3d, 4f, 4g To practise effective prereading strategies. To practise skimming a text to locate particular details. To practise using writing for learning.	Students' journals Activity 2-13 in *Science Directions*, Wiley, pages 111 and 112. OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Video camera Audiotape Videotape

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Eleven: Reinforcing Structures for Strength x indicates a process emphasized in the lesson ✓ indicates a process used in the lesson						**OBSERVATION and EVALUATION of selected students' learning and communication processes in their small group activity and journal writing.**	1. Students recall principle regarding the use of triangles as a component in the design of a structure. 2. Student explain any changes made in their preliminary design for a structure in order to apply this principle, or they explain where their original design already included this principle. 3. Students examine photographs and illustrations in their textbook, describe similarities and differences in the use of triangles in the design of different structures, pose questions about these structures, and read to find answers to their questions. 4. Working in groups of three, students preview, clarify, and carry out the task, recording their observations for Activity 2-14, pages 114 and 115. 5. Students share their designs and observations and draw tentative conclusions about the strength of corrugated materials of various designs. 6. As a homework assignment, students review the preliminary design they have created for a structure of their choice and note in their journals any modifications they would make to the original design because of what they have learned about the use of **corrugated materials** to make a structure stronger. (Some students may find that they have used this principle intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principle explored in this lesson. They should explain why this is so.)
x	x	x	✓	✓	✓		

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a Concepts: 1d, 2a, 2b, 3a, 3b, 3c, 3d, 4a, 4g To practise appropriate prereading strategies. To practise using writing for learning.	Students' journals. *Science Directions*, Wiley, pages 113 to 115. Activity 2-14 in *Science Directions*, Wiley, pages 114 and 115. **OBSERVATION/PROFILE sheet designed for use with groups (or individuals).** **Tape recorder** **Video camera** **Audiotape** **Videotape**

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

<table>
<tr><th colspan="6">PROCESSES</th><th rowspan="2">DIAGNOSTIC EVALUATION PROCEDURES</th><th rowspan="2">ACTIVITIES</th></tr>
<tr><th>EXPLORING</th><th>NARRATING</th><th>IMAGINING</th><th>EMPATHIZING</th><th>ABSTRACTING</th><th>MONITORING</th></tr>
<tr><td colspan="6">Lesson Twelve: Testing the Shape and Strength of Columns
✘ indicates a process emphasized in the lesson
✔ indicates a process used in the lesson</td><td rowspan="2">OBSERVATION and EVALUATION of selected students' learning and communication processes in their small group activity and journal writing.</td><td rowspan="2">1. Students recall principle regarding the use of corrugated materials to make a structure stronger.
2. Students explain any changes made in their preliminary design for a structure in order to apply this principle, or they explain where their original design already included this principle.
3. Working in groups of four, students preview, clarify, and carry out the task, recording their observations as directed.
4. Students report and compare their observations with those of other groups. They then draw tentative conclusions about the relationship between shape and strength of columns, explore possible reasons for differences in their observations, and explain why they think columns and beams are not always made using the strongest shape, referring to diagrams and information in their textbook.
5. As a homework assignment, students review the preliminary design they have created for a structure of their choice and note in their journals any modifications they would make to the original design because what they have learned about the relationship between **shape and strength of columns**. (Some students may find that they have used this principle intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principles explored in this lesson. They should explain why this is so.)</td></tr>
<tr><td>✘</td><td>✘</td><td>✘</td><td>✔</td><td>✔</td><td>✔</td></tr>
</table>

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 2a, 2b, 3a, 4a Concepts: 1d, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 4a, 4b, 4g To practise reading for a particular purpose. To practise using writing for learning.	Students' journals SHAPE AND STRENGTH, PART B, which is attached to the lesson plans. OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Video camera Audiotape Videotape

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Thirteen: Circles of Knowledge						OBSERVATION and EVALUATION of selected students' learning and communication processes in their previewing and reading of text, small group activity, oral presentations, feeback to other students, and journal writing.	1. Working independently, students preview the portion of the textbook related to their task and prepare written answers in response to the directions and questions under Preview on the task assignment sheet. 2. Working in task groups of three to six, students complete the activities under Group Activity and prepare to share their work with other students. 3. Working in Circles of Knowledge, students share the important ideas associated with the topic and the task they have been working on. 4. Working independently, students answer questions formulated by the students in the four other task groups in order to provide the other students with feedback on how effectively they communicated important ideas in the Circles of Knowledge. 5. Working in their task groups, students read the answers others have given to their questions, provide oral or written feedback where necessary to clarify other students' understanding of ideas, and make revisions where necessary to refine their questions. 6. Students make an entry in their journals, discussing what they have learned over the course of the activities associated with this lesson, reflecting on their personal achievements, and explaining how they might change or modify their approach to the task on a subsequent occasion.
✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson							
✔	✔	✘	✘	✘	✘		

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2, 3, 4, 5 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b Concepts: 1a, 1b, 1d, 1e, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 4a, 4e, 4f, 4g, 4h, 4i, 5a, 5b, 5c, 6a, 6b To practise appropriate prereading strategies. To practise effective speaking and listening skills. To practise using writing for learning.	CIRCLES OF KNOWLEDGE, TASKS ONE TO FIVE, which are attached to the lesson plans. Copies of illustrations of bridges, Teacher Resource Package, Wiley, page 2-43 to accompany CIRCLES OF KNOWLEDGE, TASK ONE. OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Audiotape

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UNIT PLAN

THEME Structures and Design

FOCUS Science and technology: The design and construction of materials involves the creative application of science and technology.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Fourteen: Building a Better Tower ✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson						OBSERVATION and EVALUATION of selected students' learning and communication processes in their small group activity and journal writing. CREATION OF INDIVIDUAL STUDENT PROFILES of learning and communication processes. CONFERENCING with individual students to share profiles and set goals to help them become independent users of the processes.	1. Students assist in developing criteria for the evaluation of their towers. 2. Students examine the entries they have made in their journals and consider how they can improve both the design of the tower they built in Lesson One and the planning process. 3. Working in groups of three (the same groups as in Lesson One), students plan and construct their towers, using only the materials provided. 4. The groups bring their towers to a test table to demonstrate that they are freestanding and capable of bearing the required load of 200 grams, 20 centimetres above the surface of the table without bending or collapsing. Students participate in testing and evaluating both the towers and the planning process. 5. Students make individual entries in their journals about this activity.
✔	✔	✘	✘	✘	✘		

ONGOING ACTIVITIES Students are involved in the design and construction of structures, using simple materials to solve practical problems and develop the skills of technological problem-solving.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 7 **Course** Science

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓		✓	✓	✓	✓	✓	✓	Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b Concepts: 1d, 3a, 3b, 4a, 4c, 4d, 4f, 4g, 4h, 4i To practise using writing to learn.	For each group of three students: 30 paper-clips 30 straight pins 1 spool of thread 20 plastic straws large enough in diameter to hold a paper-clip securely *Science Directions*, Wiley, page 132. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape 200-gram weight ruler bar for holding weight JOURNAL ENTRY for Lesson Fourteen: Building a Better Tower, which is attached to the lesson plans. DESCRIPTIVE SCALES OBSERVATION/PROFILE sheet for selected students. SELF-EVALUATION PROFILE SHEETS PEER-EVALUATION PROFILE SHEETS SUMMARY AND GOALS FOR IMPROVEMENT completed by each of the selected students.

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LESSON PLAN

Lesson One: Building a Tower

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 4, 6 Skills: 2a, 2b, 3a, 3b, 4a, 4b Concepts: 3e, 4g		Tell students that in this unit they will be working frequently in small groups to solve a practical problem. In each case, there will be more than one effective way to solve the problem. As they work on these problems, they will learn how to design structures that are safe and strong. State the problem for this lesson: Build the tallest tower you can using only the materials provided. Draw their attention to the list of materials to be provided and to the rules (specifications) for the tower: 1. The tower must be self-supporting. It cannot be taped, clipped, or tied to anything. 2. The tower must be constructed from the materials provided. No other materials may be used. 3. The tower must be brought to the test table and must stand	The activity can also be done with these materials, which are provided to each group of three students: 2 sheets of 8.5 x 11 paper 30 cm of masking tape scissors	For each group of three students: 30 paper-clips 30 straight pins 1 spool of thread 20 plastic straws large enough in diameter to hold a paper-clip securely

LESSON PLAN

Lesson One: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		unsupported for one minute.		
	Working individually, students make a preliminary sketch of a design that they think will meet the rules (specifications) for the tower.	Before students move into groups, have them make a preliminary sketch of a design for the tower that they think will meet the rules (specifications).		
		Assign students to groups of three. You will find it easier to make diagnostic observations and manage the rest of the class if you assign students selected for diagnostic evaluation to the same group. Audiotape and /or videotape this group's work as the students select a design and construct the tower. As time permits, record observations and evaluations of the selected students' learning and communication processes of the ESLCP, using the observation/profile sheet designed for use with groups.		OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape
	Working in groups of three, students pool their ideas, select a design, and construct a tower within a specified time period.	Instruct students to bring their individual sketches of a design for the tower to their group. These sketches will give them a starting point for selecting a design and for		

LESSON PLAN

Lesson One: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		for constructing the tower.		
		Set a time limit for completion of the towers (30 to 40 minutes should be adequate).		
	The groups bring their towers to a test table to demonstrate that they are self-supporting.	At the end of the time limit, have students bring their towers to the test table to demonstrate that they can stand unsupported for one minute.	If an evaluation is to be attached to the test, it should be a pass/fail, depending upon whether or not the tower stands on its own for one minute. It should be emphasized that it is the tower, not students, that is being evaluated. This should be provided as feedback only, not recorded for the purpose of summative evaluation.	
To practise using writing to learn.	Students make individual entries about this activity in their journals.	Ask students to make an individual entry in their journals, following the instructions provided for this writing.		JOURNAL ENTRY for Lesson One: Building a Tower, which is attached to these lesson plans.
		If students have had no previous experience with journal writing, you will need to explain how this kind of writing (writing to learn) helps them think about and clarify for themselves what they are learning, and also how it provides a record of their learning. You may need to model this kind of writing for them or make suggestions about the kinds of things they could include in their journals, based on your observation of their work	You may wish to photograph students' towers to compare them with the structures they design in response to the same problem later in the unit.	

LESSON PLAN

Lesson One: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		together. Tell students that you will be checking their journals for satisfactory completion, that you will be reading them and using them as a basis for class discussion, but that you will not be grading their journal writing. The journal entries of students selected for diagnostic evaluation can be analysed for evidence of their levels of independence in the six learning and communication processes. The journals of other students can be read for what they reveal about students' understanding of their learning experiences, including any problems they are having that will need to be addressed to facilitate understanding.	Note that the journal assignment incorporates sketches of students' own designs as well as the design selected by the group for its tower. When students have learned more about the principles of structure and design and are preparing to repeat this problem-solving activity at the end of the unit, they can return to their sketches to examine the principles they employed and the things they want to change in their second design.	

LESSON PLAN

Lesson Two: Designs in Natural and Manufactured Structures

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 3, 4, 5 Skills: 1a, 1b, 2a, 3b, 4a, 4b Concepts: 1a, 1b, 1c, 1d, 1e, 2a, 2b, 3c, 4h	Students read their journal entries for Lesson One, and through guided discussion, generate tentative generalizations about technological problem-solving.	Use students' journal entries to review, extend, and refine what they learned in Lesson One. Ask a few students to read their journal entries and then use what they offer to focus discussion on areas that will lead to some tentative generalizations about technological problem-solving: 1. the things students took into consideration in planning and selecting a design for their tower (efficient and effective use of materials, stability, appearance, perhaps even safety if straight pins were used) 2. problems encountered and troubleshooting to solve problems 3. decisions and actions that were successful 4. improvements they would make on the process and outcome You may also wish to use this opportunity to explain the six learning and communication		Students' journal entries from Lesson One.

LESSON PLAN

Lesson Two: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		processes and point out examples of them in students' journal writing.		
		Before assigning pages 74 to 79 for reading, involve students in some prereading activities to help them recall what they know that is relevant to their reading and to help them establish purposes for their reading. The following prereading activities will help to ensure better comprehension of the information in the textbook:		*Science Directions*, Wiley, pages 74 to 79.
To practise appropriate prereading strategies.	Students engage in prereading activities to establish purposes for their reading of the relevant sections of their textbook.	1. Ask students to define the words *structure*, *design*, *natural*, and *manufactured*. Write these on the chalkboard or the overhead. The definitions students offer may fall short of the precision of scientific definitions. Rather than correcting their definitions, explain the importance to science of precise definitions. Tell them that these words are defined in the textbook and ask them to check their definitions against those in the textbook.		

LESSON PLAN

Lesson Two: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		One purpose for their reading will have been established—to confirm, extend, and refine their understanding of how these words are used in a scientific context. 2. Guide students through a preview of the part of the textbook they will read. Previewing helps students establish a general overview of what is being communicated before they begin to read the information. It helps them see the forest before they get lost in the trees. Previewing focuses students' attention on the special features of the textbook that help them follow and comprehend information (e.g., use of white on black and different type sizes to emphasize headings and subheadings, use of boldface type to emphasize important words). Previewing also focuses on recurring features in the		

LESSON PLAN

Lesson Two: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		textbook related to organization and presentation (e.g., the pattern in the activities—problem, materials, procedure, and the different kinds of questions—Probing, Finding Out). Students need to become consciously aware of these features and their purposes in order to read their textbook with maximum comprehension. Previewing also involves an examination of the photographs and illustrations to explore what is being communicated. Students will probably notice that all the photographs and illustrations on pages 74 to 79 compare and contrast natural and manufactured structures. If they have previewed this visual material, students will have a good idea of the purpose of this information before they begin reading.		

LESSON PLAN
Lesson Two: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		During these previewing activities, encourage students to pose questions that will help them establish purposes for their reading.		
	Students read the information on pages 74 to 77 of the textbook. Working in groups of three, they discuss how their definitions of *structure*, *design*, *natural*, and *manufactured* may need to be extended and refined to make them more precise, and they write down their suggested revisions. They discuss answers for questions under Probing, page 77. They discuss and prepare written answers for questions and directions under Procedure, Finding Out, and Finding Out More for Activity 2-1, pages 78 and 79.	Assign students to groups of three to facilitate collaborative learning as they work on Activity 2-1. Group students selected for diagnostic evaluation together and audiotape their discussion. As time permits, record observations and evaluations of selected students' learning and communication processes, using the observation/profile sheet designed for use with groups.		OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape
To practise using writing to learn.	As a homework assignment, students write a brief entry in their journals, recording the important things they learned in today's lesson and listing some manufactured structures they observe in their homes or neighborhoods that are similar in design to natural	Make suggestions for the kinds of things students might write about (e.g., problem solving, scientific definitions of words, natural and manufactured structures, previewing information in a textbook before reading).		

LESSON PLAN

Lesson Two: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	structures.	The journal entries of students selected for diagnostic evaluation can be analysed for evidence of their levels of independence in learning and communication processes.		

LESSON PLAN

Lesson Three: Relating Function and Design

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2 Concepts: 1d, 2a, 2b, 3c, 5c	Students present their answers for the exercises in Activity 2-1, pages 78 and 79. They also give examples from their journals of manufactured structures they have observed in their homes or neighborhoods that are similar in design to natural structures.	Facilitate discussion.		Activity 2-1 in *Science Directions*, Wiley, pages 78 and 79. Students' journals
		Tell students that they will be examining some objects that they may not have seen before and will be trying to guess what they are used for. The goal is not that students get the right answer but rather that they examine the design of the structure carefully and use their imaginations to think of something that the object could be used for. Ask them not to reveal what the object is really used for if they happen to know—let others guess first.		
	Students guess the possible functions of unfamiliar objects, relating their guesses to the design of the structure.	Show students the objects. Ask them to give reasons for the uses they suggest by referring to the design of the structure.	The illustrations on pages 2-16 to 2-18 of the Teacher Resource Package for *Science Directions* could be used for this purpose.	Several objects that are likely to be unfamiliar to students, such as: melon scoop meatball maker honey stirrer staple remover tuning fork

LESSON PLAN

Lesson Three: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	Working in groups of three, students complete Activity 2-4, numbers 2 and 3, taking turns selecting objects for which the other group members must devise novel functions.	Explain to students that this activity will test their powers of observation and imagination even further because they must think of unusual, original uses for common, everyday objects. Demonstrate by having students suggest other uses for the jar and the ruler, in addition to those mentioned in Activity 2-4, number 1.		Activity 2-4 in *Science Directions*, Wiley, page 86.
		Assign students to groups of three. Group students selected for diagnostic evaluation together and audiotape their discussion. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups.		OBSERVATION/ PROFILE sheet designed for use with groups. Tape recorder Audiotape
To practise using writing to learn.	As a homework assignment, relating this lesson to environmental concerns, students make a list in their journals of five or six objects that their family commonly discard as garbage. With the assistance of some of their family members, they list two	Brainstorm a few examples to give students some ideas to start with—brown paper bags could be used to wrap parcels for mailing, jumbo milk cartons could be used as children's blocks, etc.		

LESSON PLAN

Lesson Three: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	or three functions each object could serve if it was not thrown away.			

LESSON PLAN

Lesson Four: Using Similar Materials to Create Different Designs to Serve Various Functions

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 4, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b Concepts: 3c, 3d, 3e	Students share some of their lists of novel uses for commonly discarded objects.	Facilitate discussion.	Students' suggestions might be published in the school's newsletter to parents.	Students' journals
To practise appropriate prereading strategies.	Students preview pages 88 and 89 of their textbook. Students suggest alternative designs to perform the function specified for Task 1.	Ask students to preview pages 88 and 89 before beginning activity 2-5. Review and demonstrate the task, the specifications, the method of recording data, and the procedures to be followed by doing Task 1 together and considering one or two alternative designs that would work to perform the function required.		Activity 2-5 in *Science Directions*, Wiley, pages 88 and 89. (See page 88 for other materials required for this activity.)
	Working in groups of three, students design structures to perform the functions specified for Tasks 2 to 8 and record the task, materials used, the design, observations, and any problems with the design. Students then answer questions 1, 2, and 4 under Finding Out and question 5 under Extension.	Assign students to groups of three. Group students selected for diagnostic evaluation together. Audiotape, or videotape, their work. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups.	To encourage students to monitor their own performance in small group situations, you could use or adapt to your purposes the Group Evaluation form in the Teacher Resource Package, page 1-18. As part of the debriefing discussion for this lesson, students could be asked to rate their group's performance and to consider the value of collaboration to problem-solving tasks. Students could be shown	OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape

LESSON PLAN

Lesson Four: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	Students share their designs for structures and their answers to questions assigned.	Ask representatives from different groups to draw the structures they designed on the chalkboard or overhead to illustrate alternative approaches.	transparencies of other student designs in the Teacher Resource Package, pages 2-19 to 2-22.	

LESSON PLAN

Lesson Five: Review

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 4, 5 Skills: 1a, 1b, 2a, 2b, 4a Concepts: 1a, 1d, 1e, 2a, 2b, 3c, 3d		Explain the purpose of the Checkpoint questions. If you have asked students to monitor their performance in small group situations in Lesson Four, you could ask them to examine their self-evaluation for that lesson and set appropriate goals for themselves in their small group discussions in this lesson.	If you have not previously asked students to monitor their performance in small group situations, this lesson would be very good for that purpose. The questions are quite challenging and students will require a focused group effort to answer them.	Checkpoint in *Science Directions*, Wiley, page 92.
	Working in groups of three, students discuss and answer review questions based on previous lessons.	To provide a context for collaborative learning, assign students to groups of three to discuss and answer the review questions. Group students selected for diagnostic evaluation together and audiotape their discussion as they answer the questions. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups. As well, collect the sketch (or sketches) done in response to question 6 by students who were selected for diagnostic evaluation and analyse this form of representation for what it may reveal about		OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape

LESSON PLAN

Lesson Five: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		their levels of independence in learning and communication processes. Facilitate discussion.		
To practise self-evaluation of collaborative learning skills.	Students share their answers to review questions. Students evaluate their performance in the small group discussion of answers to review questions.	Provide the groups with some feedback based on your own observations of their work together.		Group Evaluation form in the Teacher Resource Package, Wiley, page 1-18.

LESSON PLAN

Lesson Six: Quiz

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 4 Skills: 1a, 1b Concepts: 1d, 2a, 2b, 3a, 3c, 3d, 3e		Activity 2-6 is used as a quiz to assess how well students can independently answer questions related to previous lessons. The questions give students some scope for choice in their answers and also enable them to draw upon personal experience (structures within their own neighborhood, for example).		Activity 2-6 in Science Directions, Wiley, pages 90 and 91.
		Explain the purpose of the quiz and the criteria upon which students' answers will be evaluated.		
	Working independently, students prepare written answers for questions under What's the Purpose?, Finding Out, and Finding Out More, pages 90 and 91.	In addition to evaluation for summative purposes, the written work of students selected for diagnostic evaluation can be analysed for evidence of their levels of independence in learning and communication processes. Consider conferencing with these students to probe the thinking behind their answers as a means of confirming, extending, and refining your evaluation of their use of the six processes.		

LESSON PLAN

Lesson Six: Quiz

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Ask the students selected for diagnostic evaluation to review samples of some of their work done up to this point and complete a self-evaluation of their own learning and communication processes. If time permits, you may be able to conduct individual conferences with the students selected for diagnostic evaluation. This will enable you to share your evaluations with individual students, compare your evaluations, and begin to set goals to help them develop more independence in the six processes.	Ask each student to select a classmate who will examine the same data and do a peer evaluation of his or her learning and communication processes.	OBSERVATION/PROFILE SHEET designed for use with individuals

LESSON PLAN

Lesson Seven: Strength of Materials—Compression and Tension

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1a, 1b Concepts: 2b, 3d, 3e, 4a, 4b, 4c, 4d, 4e, 5a, 5b, 5c To practise appropriate prereading and postreading strategies.	To acquire background knowledge for designing and carrying out their own experiments to test compressive and tensile strength of materials, students read Topic Three—Materials Matter, pages 93 to 101 of their textbook.	To ensure adequate comprehension, guide students through a preview of the chapter, focusing on headings and subheadings, illustrations, and words in boldface type. Ask students to predict what this section will be about.		Topic Three – Materials Matter in *Science Directions*, Wiley, pages 93 to 101.
		Show them how to set purposes for their reading by turning the headings and subheadings into questions (e.g., Why do materials matter? How do you choose the best materials? What makes some materials stronger than others?). If students develop the habit of formulating questions as they read their textbook, they will read more actively and with greater comprehension because they are reading to answer their own questions.	You could ask students to jot their questions down as they read. Then, to test their understanding of what they have read, let them ask each other their questions. By listening to their questions and answers, you will get a good sense of what they have understood and where you need to intervene to help them extend and refine their understanding.	
	Working in groups of three, students design and carry out experiments to test the compressive and tensile strength of materials provided. They also prepare written responses to questions and directions provided.	Assign students to groups of three, placing students selected for diagnostic evaluation together. Audiotape and/or videotape their work. As time permits, record observations and evaluations of their learning and communication	If students need to review how to formulate a hypothesis and design an experiment, refer to Skillbuilder Two: Science Skills in *Science Directions*, Wiley, pages 351 to 354.	TESTING THE STRENGTH OF MATERIALS, which is attached to these lesson plans. (Specific materials needed for this activity are listed on the handout.)

LESSON PLAN

Lesson Seven: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		processes, using the observation/profile sheet designed for use with groups.		OBSERVATION/PROFILE sheet designed for use with groups.
	To the class, students report their hypotheses, the procedures used to test their hypotheses, their rankings of the compressive and tensile strength of the materials tested, and their examples of situations requiring the use of materials that have a high compressive or a high tensile strength.	Facilitate discussion. Students' reports could also encompass problems they encountered, how they solved them, or why they think they were unable to solve them. Alternative ways of testing the compressive and tensile strength of the materials could be explored.		Tape recorder Video camera Audiotape Videotape
		Collect the written work of students selected for diagnostic evaluation. Analyse this for evidence of their levels of independence in learning and communication processes.		
To practise using writing to learn.	As a homework assignment, students apply concepts from their reading and experiments in an individual journal entry, in which they explore possibilities for a structure they would like to design for their own use or for an imaginary teenager of the future.	The journal entries of students selected for diagnostic evaluation can also be analysed for evidence of their levels of independence learning and communication processes.	As an alternative to this journal-writing assignment, you might ask students to collect pictures from newspapers or magazines of structures that employ the principles of structure and design, or ask them to make sketches of structures that they have observed in their homes	JOURNAL WRITING ASSIGNMENT for Lesson Seven: Strength of Materials, which is attached to these lesson plans.

LESSON PLAN

Lesson Seven: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
			and neighborhoods that employ these principles. In their writing accompanying these illustrations, they could identify the components of the design that provide strength and support, explain their function, and speculate on the relationship among factors that influence design and choice of materials.	

LESSON PLAN

Lesson Eight: Designing for Support and Strength

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 1b, 2a, 4a Concepts: 2a, 2b, 3b, 3c, 3d, 3e, 4c, 4d, 4e, 4f, 4g, 5a, 5b, 5c	Students recall and summarize the experiments they conducted in the previous lesson.	Review the concepts of compressive and tensile strength by asking students to recall and summarize what they did in the previous lesson.		Students' journals
		Ask students to exchange journals with a partner of their choice. Ask them to write a response to their partner's ideas, telling what they like about the design and contributing suggestions for refinement for their partner to consider.		
	Students respond to one another's journal entries.	Ask a few students to share their journal entries with the rest of the class. If students are reluctant to volunteer, you might ask, "Who saw an interesting design that you think the rest of the class would like to see?" If students are encouraged by their peers, they may be more willing to share their work. Encourage other students to contribute suggestions for the writer/designer to consider.	You might also use this opportunity to review the six learning and communication processes and comment upon examples of them in the students' journal entries.	
		The transition to Activity 2-10 could be made by suggesting that students may learn some things about designing for		

LESSON PLAN

Lesson Eight: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		support and strength in this activity that will be helpful to them as they refine the design of the structures they have created in their journal entries.		
To practise appropriate prereading strategies.	Students preview the relevant parts of their textbook to establish the problem and the nature of the task they will be undertaking.	Ask students to skim page 102 and explain the problem illustrated there. Ask them to read the introductory information on page 102 and to preview activity 2-10. When they move into groups, they should begin by making sure they understand the task.		Activity 2-10 in *Science Directions*, Wiley, pages 102 and 103.
	Working in groups of three, students clarify the task for themselves, follow directions, make sketches where appropriate, and discuss and prepare written answers for questions under Finding Out and Finding Out More on page 103.	Assign students to groups of three, placing students selected for diagnostic evaluation together. Audiotape and/or videotape their work. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups.		OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape
	Students share their answers to questions with the rest of the class.	Facilitate discussion. On the chalkboard or overhead, list the alternatives that students suggest for question number 3. Then ask them to skim		

LESSON PLAN

Lesson Eight: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To practise skimming a textbook to locate particular details.	Students skim the textbook to locate particular details.	page 104 in their textbook to find three ways to prevent a beam from bending or breaking. To reinforce the meaning of skimming, ask students how they located this information. (They will probably mention the key words "bending," "breaking," and "avoided"; the numbers 1 to 3; and the visual clue in the format—the items of information are listed.)	Make sure students understand the difference between skimming for particular items of information and ordinary reading.	Bending and Breaking in *Science Directions*, Wiley, page 104.
	Students categorize their suggestions for preventing a beam from bending or breaking.	Ask students to categorize their suggestions in response to question number 3 in terms of the three ways of preventing bending and breaking listed on page 104. (Where have they proposed using stronger materials, adding a structure to support the beam, and altering the design of the beam to make it stronger?) Students may be able to generate more suggestions at this point. Collect the written work of students selected for diagnostic evaluation.		

LESSON PLAN

Lesson Eight: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Analyse their sketches and writing for evidence of their levels of independence in the learning and communication processes.		

LESSON PLAN

Lesson Nine: Testing the Shape and Strength of Beams

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 4 Skills: 1a, 1b, 2a, 3a, 4a Concepts: 1a, 1b, 2a, 2b, 3b, 4a	Students recall methods for preventing a beam from bending or breaking.	Ask students to recall the three methods to prevent a beam from bending or breaking. Tell them that in this lesson they will participate in an activity in which they will learn more about the third of these alternatives—changing the design of a beam to make it stronger.	Rather than having the whole class work through all the activities for Lessons Nine to Twelve, you might assign these to different groups. Have the groups report back to the whole class on the problem, the procedures, their observations, and the practical application of principles of structure and design associated with the activity. Because similar processes are involved in each activity, this might be a more economical use of time and other resources. It would also give students an opportunity to practise and develop their communication skills for a more public audience (their peers). The groups could be encouraged to monitor and evaluate their group skills using the Group Evaluation form in the Teacher Resource Package, Wiley, page 1-18. The same journal-writing assignments could be used. In fact, the groups could provide expert assistance to one another.	

LESSON PLAN

Lesson Nine: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	Working in groups of four, students preview, clarify, and carry out the tasks, recording observations as directed.	Assign students to groups of four, placing students selected for diagnostic evaluation together. Audiotape and/or videotape their work. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups.	At this point, you may have gathered sufficient data about the selected students' levels of independence in learning and communication processes that you might want to try a different kind of grouping. Place these students in groups where they will encounter others who can model independence in processses where they appear to need assistance. You might also consider placing them in groups where their strengths will complement those of other students.	SHAPE AND STRENGTH, PART A, which is attached to these lesson plans. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape
	Students report and compare their observations with those of other groups. They draw tentative conclusions about the relationship among orientation, shape, and strength of beams. They explore possible reasons for differences in their observations.	Facilitate discussion. Students might be asked to suggest an appropriate name for each of the four beams.		
To practise appropriate prereading strategies.	Students preview and read pages 108 and 109 of their textbook for confirmation of their conclusions, for additional information to extend and refine their understanding, and for illustrations of the practical application of this knowledge.	Ask students to tell you what they should examine in their preview of this part of the textbook and what predictions they would make about the purpose of the information, based on their preview.		

LESSON PLAN

Lesson Nine: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To practise using writing to learn.	As a homework assignment, students review the preliminary design they have created at the end of Lesson Seven for a structure of their choice, and note in their journal any modifications they would make to the original design as a consequence of what they have learned about **the orientation, shape, and strength of beams**. (Some students may find that they have used these principles intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principles explored in this lesson. They should explain why this is so.)	The journal entries of students selected for diagnostic evaluation can be analysed for evidence of their levels of independence in learning and communication processes.		

LESSON PLAN

Lesson Ten: Reinforcing Structures for Strength

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 3, 4, 5, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a Concepts: 1a, 1c, 1d, 1e, 2a, 2b, 3a, 3b, 3c, 3d, 4f, 4g	Students recall principles regarding the relationship between orientation, shape, and strength of beams. Students explain any changes made in their preliminary design for a structure to apply these principles or they explain where their original design already included these principles.	Ask students to recall principles from the previous lesson regarding the relationship among orientation, shape, and strength of beams. Ask students to report on any changes they have made to their preliminary designs for a structure because of what they learned during the previous lesson. (Some may have used these principles intuitively. Ask students if they recognized this in their designs.)		Students' journals
To practise effective prereading strategies.	Students examine illustrations in the textbook, identify the use of triangles in the design of different structures, and describe the function of this component of the design.	In this lesson, students will learn how triangles can be used in the design of a structure to lend additional support and strength to the structure. Ask students to examine the photographs and illustrations on page 111 and identify a shape that is part of the design of all four structures (coat rack, picture frame, tree, and church). Ask them to describe the function of the triangle in these structures.		Activity 2-13 in *Science Directions*, Wiley, pages 111 and 112.
To practise skimming a textbook to locate particular details.	Students skim the textbook to locate particular details.	Ask students to skim the textbook on that page to find two names that are used to		

LESSON PLAN

Lesson Ten: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		describe these kinds of triangular supports ("braces," a general term, and "buttresses," a specific kind of brace) and also to find the specific properties of triangles that provide strength and support for a tall structure (strong and rigid shape, not easily bent).		
	Working in groups of three, students preview, clarify, and carry out the tasks in Activity 2-13 on page 112.	Assign students to groups of three. Place students selected for diagnostic evaluation in the same groups or place them in groups where there are other students who have complementary strengths. Audiotape and/or videotape their work. As time permits, record observations and evaluations of their learning and communication processes. Use the observation/profile sheet designed for use with groups (if students will be placed in one group) or for use with individuals (if students are to be placed in different groups).		OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Video camera Audiotape Videotape
	Students display and demonstrate the frames they have constructed. They	Ask students to describe any other approaches they tried and whether or not they were successful.		

LESSON PLAN

Lesson Ten: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	explain how they have used triangles to make the frames more rigid.			
To practise using writing for learning.	As a homework assignment, students review the preliminary design they have created for a structure of their choice and note in their journals any modifications they would make to the original design because of what they have learned about the use of **triangles** to provide support and strength to a structure. (Some students may find that they have used this principle intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principles explored in this lesson. They should explain why this is so.)	The journals entries of students selected for diagnostic evaluation can be analysed for evidence of individual strengths and weaknesses in the six learning and communication processes.		

LESSON PLAN

Lesson Eleven: Reinforcing Structures for Strength

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a Concepts: 1d, 2a, 2b, 3a, 3b, 3c, 3d, 4a, 4g	Students recall principles regarding the use of triangles as a component in the design of a structure. Students explain any changes made in their preliminary design for a structure in order to apply these principles, or they explain where their original design already included these principles.	Ask students to recall principles from the previous lesson regarding the use of triangles to provide support and strength to a structure. Ask students to report any changes they have made to their preliminary designs for a structure because of what they learned during the previous lesson. (Some may have used this principle intuitively. Ask students if they recognized this in their designs.)		Students' journals
To practise appropriate prereading strategies.	Students examine photographs and illustrations in their textbook, describe similarities and differences in the use of triangles in the design of different structures, pose questions about these structures, and read to find answers to their questions.	Ask students to examine the photographs and illustrations on pages 113 to 115 of their textbook. Ask them to describe similarities and differences between the way they were using triangles in their work in the previous lesson and the way triangles are used in these examples. What questions would they ask about these structures? Have them read the textbook to see if they can find answers to their questions.		*Science Directions*, Wiley, pages 113 to 115.
	Working in groups of three, students preview, clarify, and carry out the task, recording their observations for Activity	Assign students to groups of three. Place students selected for diagnostic evaluation in the same		Activity 2-14 in *Science Directions*, Wiley, pages 114 to 115.

LESSON PLAN

Lesson Eleven: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	2-14 on pages 114 to 115.	groups or place them in groups where there are other students who have complementary strengths. Audiotape and/or videotape their work. As time permits, record observations and evaluations of their learning and communication processes. Use the observation/profile sheet designed for use with groups (if students will be placed in one group) or for use with individuals (if students are to be placed in different groups).		OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Video camera Audiotape Videotape
	Students share their designs and observations and draw tentative conclusions about the strength of corrugated materials of various designs.			
To practise using writing for learning.	As a homework assignment, students review the preliminary design they have created for a structure of their choice and note in their journals any modifications they would make to the original design because of what they have learned about the use of **corrugated materials** to make a structure	The journal entries of students selected for diagnostic evaluation can be analysed for evidence of their levels of independence in learning and communication processes.		

LESSON PLAN

Lesson Eleven: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES		SUPPLEMENTARY OR ALTERNATE PROCEDURES	MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY		
	stronger. (Some students may find that they have used this principle intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principles explored in this lesson. They should explain why this is so.)			

LESSON PLAN

Lesson Twelve: Testing the Shape and Strength of Columns

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 2a, 2b, 3a, 4a Concepts: 1d, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 4a, 4b, 4g	Students recall principles regarding the use of triangles as a component in the design of a structure. Student explain any changes made in their preliminary design for a structure in order to apply these principles, or they explain where their original design already included this principles.	Ask students to recall principles from the previous lesson regarding the use of corrugated materials to make a structure stronger. Ask students to report any changes they have made to their preliminary designs for a structure because of what they have learned during the previous lesson. (Some may have used this principle intuitively. Ask them if they recognized this in their designs.)		Students' journals.
		Ask students to recall the procedure they used to test the shape and strength of beams in Lesson Nine. This lesson's activity is similar, except that students will be testing the shape and strength of columns.		
	Working in groups of four, students preview, clarify, and carry out the task, recording observations as directed.	Assign students to groups of four. Place students selected for diagnostic evaluation in the same groups or place them in groups where there are other students who have complementary strengths. Audiotape and/or videotape their work. As time permits, record observations and evaluations of their learning		SHAPE AND STRENGTH, PART B, which is attached to these lesson plans.

LESSON PLAN

Lesson Twelve: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		and communication processes. Use the observation/profile sheet designed for use with groups (if students will be placed in one group) or for use with individuals (if students are to be placed in different groups).		OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Video camera Audiotape Videotape
		Facilitate discussion. Students might be asked to suggest an appropriate name for each of the four columns.		
To practise reading for a particular purpose.	Students report and compare their observations with those of other groups. They then draw tentative conclusions about the relationship between shape and strength of columns, explore possible reasons for differences in their observations, and explain why they think columns and beams are not always made using the strongest shape, referring to diagrams and information in their textbook.			
To practise using writing for learning.	As a homework assignment, students review the preliminary design they have created for a structure of their choice and note in their journals any modifications they would make to the original design because of	The journal entries of students selected for diagnostic evaluation can be analysed for evidence of their levels of independence in learning and communication processes.		

LESSON PLAN
Lesson Twelve: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	what they have learned about the relationship between **shape and strength of columns**. (Some students may find that they have used this principle intuitively and should note where they have done so. It is also possible that some students may feel that no modification should be made to their design in relation to the principles explored in this lesson. They should explain why this is so.)			

LESSON PLAN

Lesson Thirteen: Circles of Knowledge

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 3, 4, 5 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b Concepts: 1a, 1b, 1d, 1e, 2a, 2b, 3a, 3b, 3c, 3d, 3e, 4a, 4e, 4f, 4g, 4h, 4i, 5a, 5b, 5c, 6a, 6b		In this lesson, students will demonstrate their ability to preview independently a short passage of their textbook. They will then work together with a small group of students (five or six) to complete a series of activities related to the portion of the textbook they have read in common. These groups are called task groups because they will be working collaboratively on the activities associated with one of five tasks. The objective is for students in the task group to become experts on the topic related to the task so that they can explain the important ideas to other students who have been working on other topics in other task groups. When all five groups have completed the activities related to their task, students are reassigned to other groups so that there is an expert from each of the five task groups in each new grouping. These new groupings are called Circles of Knowledge. The experts		CIRCLES OF KNOWLEDGE, TASKS ONE TO FIVE, which are attached to these lesson plans. Copies of illustrations of bridges, Teacher Resource Package, Wiley, page 2-43, to accompany CIRCLES OF KNOWLEDGE, TASK ONE.

LESSON PLAN

Lesson Thirteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		from each task group share their expertise with the rest of students in their Circle of Knowledge, basing their presentation on the activities they completed with the other members of their task group. Following the presentations, students answer questions prepared by the four task groups in which they were not involved so that those students have some feedback on the effectiveness of their presentations. The task groups may be self-selected or teacher-assigned. If you choose the latter, you may wish to group students selected for diagnostic evaluation together. On the other hand, you may wish to place these students with others who have complementary strengths in the six learning and communication processes. Other factors that may influence your grouping include your assessment of the difficulty of the task and your assessment of students' abilities and interests.		

LESSON PLAN

Lesson Thirteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Explain the procedures to be followed: independent previewing and reading of the textbook, collaborative work in task groups, and presentations to Circles of Knowledge. Let students choose the task they wish to work on or assign them to groups such that there are an equal number (or an approximately equal number) of students working on each task.	If students are selecting their own groups, to ensure an equal number for each task you might want to use a sign-up sheet that has only the required number of spaces and operate on a "first come, first served" basis. Students may need to have a second and third choice in mind. If the class is large, such that there are six or seven students working on each task, you may want to divide these into smaller groups of three or four.	
To practise appropriate prereading strategies.	Working independently, students preview the portion of the textbook related to their task and prepare written answers in response to the directions and questions under Preview on the task assignment sheet.	Because students have had several opportunities to practise previewing, you may wish to evaluate their written responses and assign a mark for summative purposes. If you decide to do this, inform students of the criteria you will be using to evaluate their responses.		
	Working in task groups of three to six, students complete the activities under Group Activity and prepare to share their work with other students.	Record observations of students selected for diagnostic evaluation as they work on this task. Examine their written responses for evidence of independence in the six processes.		OBSERVATION/PROFILE sheet designed for use with groups (or individuals).

LESSON PLAN

Lesson Thirteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Audiotape the group activities of students selected for diagnostic evaluation. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups (or individuals). You might also consider taking some time to conference with individual students to encourage self-evaluation on their part and to confirm, extend, and refine your own evaluations of their strengths and weaknesses.	Collaboration with your teacher-librarian would be desirable. He or she can assist students to find the appropriate resources for the research activities associated with TASKS THREE AND FIVE. Students will probably need help in formulating the two questions to ask other students to see how effectively they have communicated the important ideas in their presentation. They may need some models to encourage them to focus on main ideas rather than isolated details. To encourage students to monitor their own performance in the task group, you may wish to have them complete the Group Evaluation form in the Teacher Resource Package, Wiley, page 1-18. If you wish to encourage students to evaluate and monitor their individual performance, see the Junior High Language Arts Curriculum Guide.	OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Audiotape

LESSON PLAN

Lesson Thirteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
			Appendices 3 and 4, for two models that could be adopted or adapted to your purposes.	
To practise effective speaking and listening skills.	Working in Circles of Knowledge, students share the important ideas associated with the topic and the task they have been working on.	Audiotape the presentations of Circles of Knowledge in which students selected for diagnostic evaluation are involved. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups (or individuals). You have an opportunity in this lesson to track students' progress from language for learning (in the task group) to language for a more public audience (their peers in the Circles of Knowledge).	If you want students to provide feedback to each other about their speaking and listening skills, see the Junior High Language Arts Curriculum Guide, Appendices 8, 14, and 15, for three models that could be adopted or adapted to your purposes.	OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Audiotape
	Working independently, students answer questions formulated by students in the four other task groups in order to provide the other students with feedback on how effectively they communicated important ideas in the Circles of Knowledge.	Emphasize that the students are answering the questions to provide feedback to others on how effectively they communicate and to get clarification themselves if there is something they have not understood.	At a later point, after students have received clarification where ideas may not have been communicated effectively or understood clearly, and after the questions have been refined where necessary, the questions might be used as a quiz and	

LESSON PLAN

Lesson Thirteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
			students' responses evaluated for summative purposes.	
	Working in their task groups, students read the answers others have given to their questions, provide oral or written feedback where necessary to clarify other students' understanding of ideas, and make revisions where necessary to refine their questions.	Audiotape the work of task groups where students selected for self-evaluation are involved. As time permits, make observations of individual strengths and weaknesses in the six learning and communication processes, using the observation/profile sheet designed for use with groups (or individuals).		OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder Audiotape
		Collect the answers to questions and the written comments made on other students' answers, which were done by students selected for diagnostic evaluation. Analyse these for evidence of individual strengths and weaknesses in the six learning and communication processes.		
To practise using writing for learning.	Students make an entry in their journals, discussing what they have learned over the course of the activities associated with this lesson, reflecting on their personal	The journal entries of students selected for diagnostic evaluation can be analysed for evidence of individual strengths and weaknesses in the six		

LESSON PLAN

Lesson Thirteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	achievements, and explaining how they might change or modify their approach to the task on a subsequent occasion.	communication processes.		

LESSON PLAN

Lesson Fourteen: Building a Better Tower

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Attitudes: 1, 2, 3, 4, 6 Skills: 1a, 1b, 2a, 2b, 3a, 3b, 4a, 4b Concepts: 1d, 3a, 3b, 4a, 4c, 4d, 4f, 4g, 4h, 4i		The purpose and procedures of this lesson are similar to those of Lesson One: students will work in the same groups of three and use the same materials to construct a tower. However, in this lesson, the task will be more challenging. The objective is to establish a problem-solving situation in which students will be called upon to apply many of the concepts they have learned that relate to structures and design. The towers will be evaluated against a more rigorous set of criteria this time. As before, the tower must be the tallest possible free-standing structure, but in addition, it must support a weight of 200 grams at 20 centimetres above the surface of the test table. Other criteria for evaluating the work will be established by the teacher and students.		For each group of three students: 30 paper-clips 30 straight pins 1 spool of thread 20 plastic straws large enough in diameter to hold a paper-clip securely
	Students assist in developing criteria for the evaluation of their towers.	Introduce the problem. Ask students to suggest other criteria, in addition to the load-bearing specification mentioned above, for the	One Grade 7 class suggested the following criteria for evaluating the towers: strength (supports 200 grams)—25 marks; height—5 marks;	

LESSON PLAN

Lesson Fourteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		evaluation of the towers and also of the planning process.	appearance—10 marks; organization and effort of the group—10 marks	
		Remind students of these other specifications for the tower: 1) It must be self-supporting, not taped, tied or clipped to anything else. 2) It must be constructed only from the materials provided. 3) It must be brought to the test table for the load-bearing test.		
	Students examine the entries they have made in their journals and consider how they can improve both the design of the tower they built in Lesson One and the planning process.	Before students begin to plan the towers, show them how to construct rigid and mobile joints using straws and paper-clips. They might also make a list of key words to remind them of important ideas that relate to structures and design. They should examine the journal entries that they have written, beginning with the entry for Lesson One, where they sketched their previous designs and considered how they might improve both the product and the planning		*Science Directions*, Wiley, page 132.

LESSON PLAN

Lesson Fourteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	Working in groups of three (the same groups as in Lesson One), students plan and construct their towers, using only the materials provided.	process. Audiotape and/or videotape the work of students selected for diagnostic evaluation. As time permits, record observations and evaluations of their learning and communication processes, using the observation/profile sheet designed for use with groups.		OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Video camera Audiotape Videotape
		Set a time limit for completion of the towers (30–40 minutes may be adequate).		
	The groups bring their towers to a test table to demonstrate that they are free-standing and capable of bearing the required load of 200 grams, 20 centimetres above the surface of the table without bending or collapsing. Students participate in testing and evaluating both the towers and the planning process.	Provide weights and other materials necessary for the test and demonstrate how the test should be carried out to provide a consistent, fair assessment (or ask students to suggest how this could be done). Test and evaluate the strength of the structures.		200 gram weight ruler bar for holding weight
		Involve students in the evaluation of other specifications for the tower and of the planning process related to the criteria previously established. If possible, photograph students' towers.	A form might be provided (or improvised) so that students could evaluate their towers and those of other students and make comments on the specific strengths of the towers in relation to the criteria established.	

LESSON PLAN

Lesson Fourteen: (Cont'd)

Theme Structures and Design **Grade** 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
			The groups could evaluate their own organization and effort, using a form such as Group Evaluation, in the Teacher Resource Package, Wiley, page 1-18. Or you could use their comments in their journals to complement your own evaluation of their planning process.	
To practise using writing to learn.	Students make individual entries in their journals about this activity.	The journal entries of students selected for diagnostic evaluation can be analysed for evidence of their levels of independence in learning and communication processes. They can also be compared with students' journal entries for Lesson One to evaluate development of strengths and of ability to use effectively the language associated with structures and design.		JOURNAL ENTRY for Lesson Fourteen: Building a Better Tower, which is attached to these lesson plans.
		For each of the students selected for diagnostic evaluation, construct a profile showing how independently he or she can use the six learning and communication processes.		DESCRIPTIVE SCALES OBSERVATION/PROFILE SHEET for each student SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS
		Ask the students to create profiles for themselves based		

LESSON PLAN

Lesson Fourteen: (Cont'd)

Theme Structures and Design

Grade 7 **Course** Science

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		evaluations. Use the profiles to set goals and plan instructional activities for the next unit of work to help the students become more independent in their use of the learning and communication processes.		SUMMARY AND GOALS FOR IMPROVEMENT completed by each student.

Student Materials

JOURNAL ENTRY

for Lesson One: Building a Tower

Include in your journal the sketch that **you** made of a design for the tower **before** you met with your group.

Describe how your group went about solving the problem of building the tower from the materials you were given. Use the questions and directions below as guidelines for what to include in your journal entry.

- When your group was trying to choose a design for your tower, what alternatives (different designs) did you consider?
- Make a sketch of the tower that your group constructed.
- Explain why you chose this design. Point out any specific features of the design that help to make the structure strong. Explain how they do this.
- Describe the most difficult problem that you had in constructing your tower. Explain how you solved this problem. (If you couldn't solve the problem, try to explain why you couldn't solve it.)
- Describe three decisions you made (or three things you did) that worked out successfully while you were building the tower.
- If you could plan and construct another tower, what would you do differently next time?

TESTING THE STRENGTH OF MATERIALS.

A. Squashing Materials to Test Their Compressive Strength

1. Before you begin this activity, write a definition for each of these words to make sure that you understand their meaning:
   - compression
   - compressive strength

2. Collect these materials for your group:
   force meter
   c-clamp
   sugar cube
   eraser
   sponge
   chalk

3. Using the materials you have collected, design an experiment to test the compressive strength of the sugar cube, eraser, sponge, and chalk. Before you carry out the experiment, do the following:
   - write a hypothesis explaining what you think will happen when you test the compressive strength of the four materials
   - describe the procedure you will use to test your hypothesis

4. After you have carried out the experiment, rank the four materials from greatest to least compressive strength.

5. Think of three situations in which it would be important to use materials that have a high compressive strength.

B. Pulling Materials Apart to Test Their Tensile Strength

1. Before you begin this activity, write a definition for each of these words to make sure that you understand their meaning:
   - tension
   - tensile strength

2. Collect these materials for your group:
   force meter
   string
   thread
   tissue paper
   bond paper

3. Using the materials you have collected, design an experiment to test the tensile strength of the string, thread, tissue paper, and bond paper. Before you carry out the experiment, do the following:

   - write a hypothesis explaining what you think will happen when you test the tensile strength of the four materials
   - describe the procedure you will use to test your hypothesis

4. After you have carried out the experiment, rank the four materials from greatest to least tensile strength.

5. Think of three situations in which it would be important to use materials that have a high tensile strength.

JOURNAL WRITING ASSIGNMENT

for Lesson Seven: Strength of Materials

Think of an interesting structure that you would like to build for your own room OR that you think a teenager of the year 2050 might have in his or her room. Make a preliminary sketch of the design of this structure.

Explain the function of the structure you have created and the relationship between its function and its design.

Think about the materials you would use to build this structure. Explain how your choice of materials for this structure has been influenced by factors such as:

- compressive strength
- tensile strength
- possibility of material failure
- cost
- appearance
- environmental considerations
- safety

As you work through the next few lessons, you will be asked to reexamine your preliminary design and choice of materials and to record any revisions to these that you would want to make as you learn more about structures and design.

SHAPE AND STRENGTH

PART A

Problem

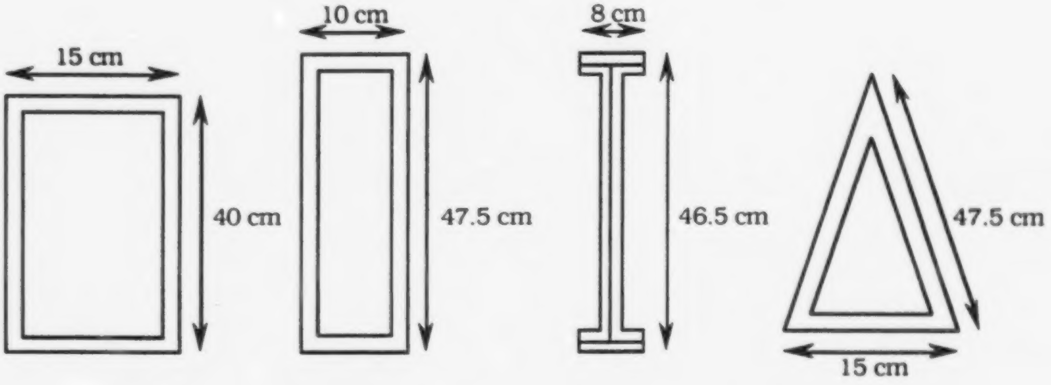
Which shape of beam can support the greatest load?

Materials

four pieces of paper or cardboard, 125 cm x 278 cm
tape
small container
several marbles
books to act as a support

Procedure

1. Have each person in your group of four make **one** of the beams illustrated below. Each person should make a different beam so that you have four different shapes of beams to test.



2. Test the beams one at a time:

   a. Make a simple bridge by placing the beam across two piles of books.
   b. Make a sketch of the end of the beam to illustrate its orientation; e.g., whether you have it on its wide edge ▭ or its narrow edge ▯.
   c. Place a small container at the centre of the beam.
   d. Add marbles one at a time until the beam begins to bend.
   e. Record the number of marbles in the container in the centre of your sketch.
   f. Change the orientation of the beam and repeat steps (b) to (e).

Observations

Use diagrams to rank the eight orientations of the four beams from strongest to weakest.

SHAPE AND STRENGTH

PART B

Problem

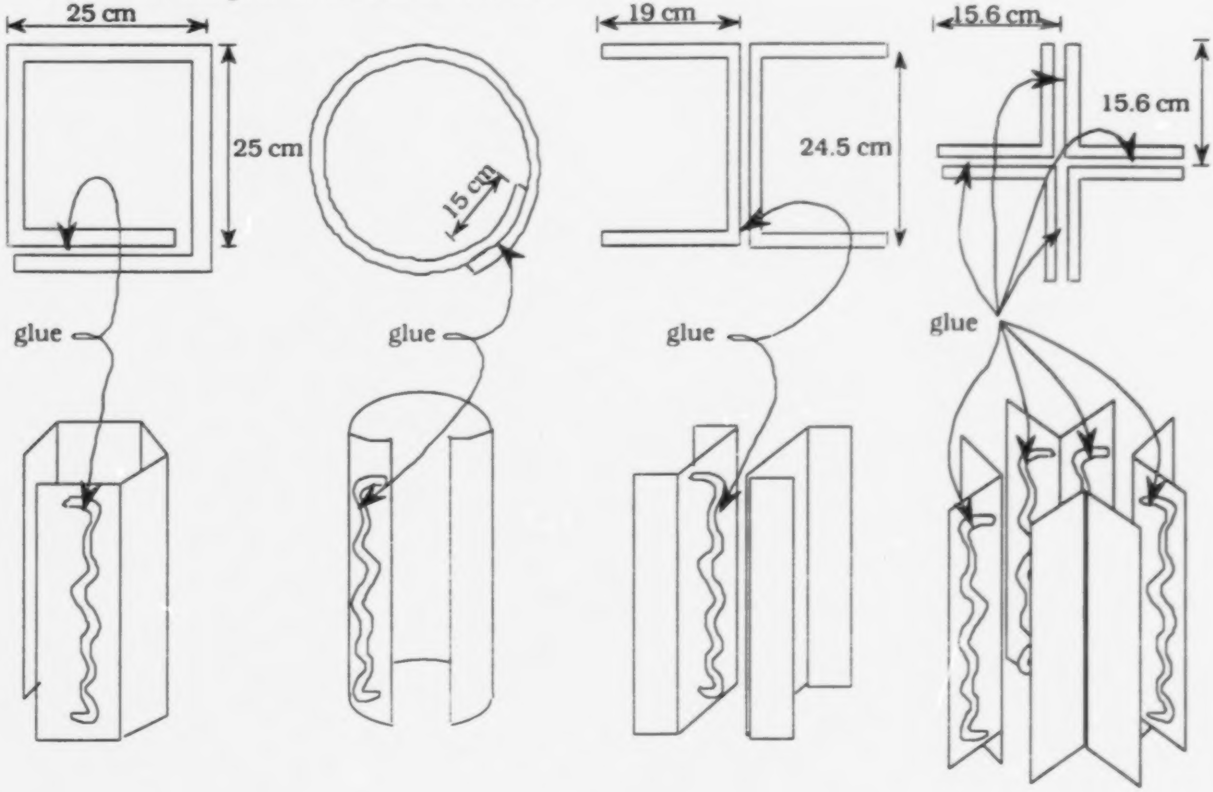
Which shape of column can support the greatest load?

Materials

four pieces of paper or cardboard, 125 cm x 215 cm
glue
small container
several marbles

Procedure

1. Have each person in your group of four make **one** of the columns illustrated below. Each person should make a different column so that you have four different shapes of columns to test.


25 cm
25 cm
15 cm
19 cm
24.5 cm
15.6 cm
15.6 cm
glue
glue
glue
glue

2. Test the columns one at a time:

   a. Stand the column upright.
   b. Make a sketch of the end of the column to illustrate its shape; e.g., ☐.
   c. Place a small container on top of the column.
   d. Add marbles one at a time until the column falls over or begins to bend.
   e. Record the number of marbles in the container in the centre of your sketch.
   f. Repeat steps (a) to (e) with the other columns.

Observations

Use diagrams to rank the four columns from strongest to weakest.

Extension

Can you explain why columns and beams are **not** always made using the strongest shape? (You may find a helpful clue on page 116 of your textbook. Read pages 117–118, too, to find out more about columns, some problems with their use in buildings, and a solution people have devised to solve these problems.)

CIRCLES OF KNOWLEDGE

TASK ONE

This task has two parts.

1. Preview the section of your textbook indicated under **Preview** and answer the questions that follow.
2. With your group, follow the directions under **Group Activity** so that you will be prepared to explain to other students the important ideas in this section of your textbook.

A. Preview

> Preview pages 119–121 of your textbook, beginning with **Activity 2-16, A Case Study: Just an Ordinary Bridge**.

On a separate sheet of paper, write answers for the following questions.

1. What did you examine in your preview? (Make a list.)
2. What predictions did you make about what you would learn when you read this information?
3. After you read the main headings and subheadings, what questions did you pose to establish a purpose for your reading?

B. Group Activity

1. Identify any important words in this section that have special meanings in science and be prepared to explain their meanings to other students.

2. Prepare answers to questions 1–5 under Finding Out and question 6 under Finding Out More on page 121 so that you can explain these to other students.

3. Examine the designs for fixed and movable bridges on the sheet distributed to you:

    a. Identify some bridges in the area where you live. Make a sketch of the bridges and label each to show what kind of bridge it is. Explain why you think this particular design was chosen for the bridge. Share this information with other students.

b. Pick one of the bridges that you think should be photographed and included in tourist information about the area where you live. Explain why you have selected this bridge. Share this information with other students.

4. Make up two questions that you could ask other students to find out how effectively you have communicated the most important ideas in your presentation to them.

CIRCLES OF KNOWLEDGE

TASK TWO

This task has two parts.

1. Preview the section of your textbook indicated under **Preview** and answer the questions that follow.
2. With your group, follow the directions under **Group Activity** so that you will be prepared to explain to other students the important ideas in this section of your textbook.

A. Preview

Preview pages 122–125 of your textbook, beginning with **Making Connections** and including questions 5, 6, and 7 under **Checkpoint** on page 125.

On a separate sheet of paper, write answers for the following questions.

1. What did you examine in your preview? (Make a list)
2. What predictions did you make about what you would learn when you read this information?
3. After you read the main headings and subheadings, what questions did you pose to establish a purpose for your reading?

B. Group Activity

1. Identify any important words in this section that have special meanings in science and be prepared to explain their meanings to other students.

2. Do **Activity 2-17** so that you can explain the problem, the procedure you followed, the prediction you made, how you tested it, and which designs produced the strongest joints.

3. Prepare answers to questions 5, 6, and 7 under **Checkpoint** on page 125 so that you can explain these to other students.

4. Make up two questions that you could ask other students to find out how effectively you have communicated the most important ideas in your presentation to them.

CIRCLES OF KNOWLEDGE

TASK THREE

This task has two parts.

1. Preview the section of your textbook indicated under **Preview** and answer the questions that follow.
2. With your group, follow the directions under **Group Activity** so that you will be prepared to explain to other students the important ideas in this section of your textbook.

A. Preview

Preview pages 126–127 of your textbook, beginning with **Science and Technology in Society.**

On a separate sheet of paper, write answers for the following questions.

1. What did you examine in your preview? (Make a list.)
2. What predictions did you make about what you would learn when you read this information?
3. After you read the main headings and subheadings, what questions did you pose to establish a purpose for your reading?

B. Group Activity

1. Identify any important words in this section that have special meanings in science and be prepared to explain their meanings to other students.

2. Carry out the activities described in 1 and 2 and answer questions 3, 4, and 5 under Think About It on page 127 so that you can explain these to other students. (You might demonstrate 1 and 2 for other students or have them try a few of these tasks themselves.)

3. Use the reference section of your library to find out about the following topics. Make notes so that you can share the information with other students.

a. The Canadarm of the Space Shuttle
   - Who invented the Canadarm?
   - What is it used for?
   - How does it work? (A sketch or a picture in a book borrowed from the library may help you explain this to other students.)
   - Compare the design and function of the artificial hand with the design and function of the Canadarm.

b. Thalidomide babies
   - What caused these babies to be born without limbs?
   - Why do you think some of these people have rejected the use of artificial limbs?
   - Some of these people have petitioned the Canadian government for compensation. Find out what they are asking for and the arguments they have presented to support their claim. Would you support their claim?

4. Make up two questions that you could ask other students to find out how effectively you have communicated the most important ideas to them.

CIRCLES OF KNOWLEDGE

TASK FOUR

This task has two parts.

1. Preview the section of your textbook indicated under **Preview** and answer the questions that follow.
2. With your group, follow the directions under **Group Activity** so that you will be prepared to explain to other students the important ideas in this section of your textbook.

A. Preview

Preview pages 128–131 of your textbook, beginning with **Putting It All Together.**

On a separate sheet of paper, write answers for the following questions.

1. What did you examine in your preview? (Make a list.)
2. What predictions did you make about what you would learn when you read this information?
3. After you read the main headings and subheadings, what questions did you pose to establish a purpose for your reading?

B. Group Activity

1. Identify any important words in this section that have special meanings in science and be prepared to explain their meanings to other students.

2. Carry out **Activity 2-18** and answer questions 1 and 2 under Finding Out on page 129 so that you can explain to other students the problem you investigated, the procedures you followed, and your answers to the questions.

3. Examine the photographs on pages 130–131. Be prepared to explain to other students:

   a. the relationship between domes and arches,
   b. the advantages of a dome design, and
   c. the problem with a dome design and how this problem can be solved.

4. Make up two questions that you could ask other students to find out how effectively you have communicated the most important ideas to them.

CIRCLES OF KNOWLEDGE

TASK FIVE

This task has two parts:

1. Preview the section of your textbook indicated under **Preview** and answer the questions that follow.
2. With your group, follow the directions under **Group Activity** so that you will be prepared to explain to other students the important ideas in this section of your text book.

A. Preview

Preview pages 133–135 of your textbook, beginning with **Building in Space.**

On a separate sheet of paper, write answers for the following questions.

1. What did you examine in your preview? (Make a list.)
2. What predictions did you make about what you would learn when you read this information?
3. After you read the main headings and subheadings, what questions did you pose to establish a purpose for your reading?

B. Group Activity

1. Identify any important words in this section that have special meanings in science and be prepared to explain their meanings to other students.

2. Make a list of all the ways in which the environments of space and underwater are similar. Make a list of all the needs that astronauts and deepsea divers have in common. Explain these similarities to other students.

3. Do **Activity 2-20**. Make a sketch that you can show to other students and be prepared to explain your design and how your space station meets the requirements of the environment that you have selected.

4. Make up two questions that you could ask other students to find out how effectively you have communicated the most important ideas to them.

JOURNAL ENTRY

for Lesson Fourteen: Building a Better Tower

Describe how your group went about solving the problem of building the tower from the materials you were given. Use the questions and directions below as guidelines for what to include in your journal entry:

- When your group was trying to choose a design for your tower, what alternatives (different designs) did you consider?
- Make a sketch of the tower you constructed.
- Explain why you chose this design. Point out any specific features of the design that help to make the structure strong. Explain how they do this. (Use the words that you have learned during this unit to talk about structures and design, such as **compressive strength, tensile strength, triangle, brace, rigid joint, mobile joint**.)
- Describe the most difficult problem that you had in constructing your tower. Explain how you solved this problem. (If you couldn't solve the problem, try to explain why you couldn't solve it.)
- Describe three decisions you made (or three things you did) that worked out successfully while you were building the tower.
- If you could plan and construct another tower, what would you do differently next time?

Science 14
Household Science: Acids and Bases

An examination of acids and bases in common household substances and safe procedures for their handling and storage

In this Diagnostic Teaching Unit, students will investigate the nature of acids and bases as part of their study of household science. They will learn how to identify acids and bases in common household substances, how to predict and use reactions of acids and bases, and how to handle and store acids and bases safely.

Lesson Summaries

There are seven lessons in this unit. The term "lesson" refers to a group of related activities that may require more than one class period to complete. Some may require less than one class period. Three options are offered for Lesson Seven, which culminates the unit. You may wish to adapt the lessons according to the needs of your students and the availability of resources. A brief summary of the lessons follows.

Lesson One: "Introduction" is intended to arouse students' interest in the unit. The activities invite them to explore prior knowledge and experience related to the safe handling of acids. Students also practice appropriate prereading strategies, small group discussion skills, and self-evaluation of their individual and group work.

Lesson Two: "Common Household Acids and Bases" involves students in an examination of acids and bases commonly used in their homes. Students practice appropriate prereading strategies and small group collaboration and discussion skills. They begin to formulate and answer their own questions related to what they are learning. They also practice the use of writing to learn.

Lesson Three: "Investigating Acidic and Basic Household Substances" introduces students to the litmus test, a scientific method used to safely test substances for the presence of acids and bases. Students practise recording observations and conclusions. They also practice skills in previewing and summarizing reading materials, carrying out investigations, asking appropriate questions, and writing to learn.

Lesson Four: "Testing Acids and Bases Using pH Meter/Paper and Natural Indicators" involves students in the selection and answering of questions they have posed related to the activities of the previous lesson. They learn two methods (the use of a pH meter or paper and the use of natural indicators) to test the strength of acids and bases. They also practise appropriate prereading, reading, and recording strategies. As well, they use imaginative writing to explore and extend their learning.

Lesson Five: "Review Test and Homework Assignment Follow-Up" challenges students to demonstrate their learning by answering questions they have previously set for themselves. They also establish criteria for evaluating the journal entries they wrote at the culmination of the previous lesson. They select questions from their journal entries to present to the class for discussion.

Lesson Six: "General Properties of Acids and Bases" involves students in investigating the chemical activity of acids and bases. They practice skills in previewing a text, and in recording procedures and observations. The also consider the practical application of the chemical reaction they have produced.

Lesson Seven: "Culminating Activity" provides three alternative activities each of which challenges students to apply their understanding of acids and bases in the creation of an original communication for a public audience. Students develop their knowledge and skills in language use, research, prereading strategies, prewriting strategies, and postwriting strategies. They also develop knowledge, skills, attitudes, and habits related to the world of work.

SCIENCE 14

HOUSEHOLD SCIENCE: ACIDS AND BASES

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Acknowledgments

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Allison Kerr—Edmonton School District #7
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Rob Smith—County of Parkland #31
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UNIT PLAN

THEME Household Science: Acids and Bases

FOCUS Acids and bases can be identified and their reactions observed in the home.

PROCESSES							DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
	EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson One: Introduction ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson	✗	✗	✗	✓	✓	✓	OBSERVATION and EVALUATION of selected students' learning and communication processes in their discussion.	1. Students participate in a prereading discussion, read an article related to the topic of the unit, and participate in a small group discussion of the article and of their own experiences with acids and bases. 2. Group leaders present their group's responses to discussion questions. 3. Students evaluate their own participation in the small group discussion.
Lesson Two: Common Household Acids and Bases ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson	✗	✗	✗	✓	✓	✓	OBSERVATION and EVALUATION of selected students' learning and communication processes in their discussion, answering questions related to the article, and journal writing.	1. Students list common household materials that may contain acids and bases. 2. Students work in pairs, reading an article and answering questions based on their reading to extend their knowledge of acids and bases in household substances and of safe handling practices related to these. 3. Students share their responses to questions with the class. 4. Students pose questions arising from the learning activities of the unit up to this point. They select those for further discussion and research, participate in answering the questions, and make an individual record of the questions and answers in their journals.

ONGOING ACTIVITIES Students will formulate their own questions related to the learning activities of the unit. They will participate in developing answers to these questions and will record both questions and answers in an ongoing journal.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 10 **Course** Science 14

CLASSROOM ORGANIZATION				STRANDS					
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING	**PROGRAM OBJECTIVES***	**MATERIALS**
✓		✓	✓	✓	✓	✓		To stimulate interest in the topic of this unit. To explore students' prior knowledge and experience related to the topic of this unit. Specific Learner Expectations: Attitudes: 2, 4 Skills: 11 To practise appropriate prereading strategies. To practise small group discussion skills. To practise self-evaluation of individual and group achievement in small group activities.	"The Foul Case of the Acid Bath Murder," attached to the lesson plans. SMALL GROUP DISCUSSION QUESTIONS for "The Foul Case of the Acid Bath Murder," attached to the lesson plans. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape "Group Effectiveness Appraisal Form" in Science 14/24 Teacher Resource Manual, page 67.
✓		✓	✓	✓	✓	✓	✓	Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 6, 11 Concepts: 2.1, 5.1, 5.3, 9.1, 9.2, 9.4 To practise appropriate prereading strategies. To practise small group discussion and collaborative learning skills. To practise using written language to learn.	Article 10.2, "Common Sense with Acids and Bases" in *Applied Science I*, Copp Clark Pitman Ltd., pages 115–116. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder(s) Audiotape(s)

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*SPECIFIC LEARNER EXPECTATIONS have been drawn from the Program of Studies for Science 14/24 as replicated in the Science 14/24 Teacher Resource Manual, pages 172 to 174. Other objectives have also been drawn from this source.

UNIT PLAN

THEME Household Science: Acids and Bases

FOCUS Acids and bases can be identified and their reactions observed in the home.

PROCESSES	EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING	DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
Lesson Three: Investigating Acidic and Basic Household Substances ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson	✓	✓	✗	✗	✗	✓	OBSERVATION and EVALUATION of selected students' learning and communication processes in their lab work, discussions, answers to questions, and journal writing.	1. Students suggest ways of testing to identify sugar and salt. 2. Students explain why a taste test would not be advisable to distinguish between acids and bases. 3. Students observe a teacher demonstration of the litmus test, discuss observations and interpretations, and record these on a chart. 4. Students preview the relevant sections of their textbook. 5. In pairs, students carry out the litmus test, using a variety of substances. They record observations and interpretations. 6. In pairs, student discuss and answer textbook questions related to the lab. 7. Students write individual journal entries about the activities of this lesson and formulate questions to extend their learning.
Lesson Four: Testing Acids and Bases Using pH Meter/Paper and Natural Indicators ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson	✓	✓	✗	✗	✗	✗	OBSERVATION and EVALUATION of selected students' learning and communication processes in their lab work and journal writing. Student SELF-EVALUATION and PEER EVALUATION of learning and communication processes in their work during Lesson One to Four: discussions, lab work, answers to questions, and journal writing. CONFERENCING with individual students to share observations of their learning and communication processes.	1. Students share the journal entries written for Lesson Three. 2. Students participate in selecting questions from those generated in journal writing and in formulating answers to these. They record both questions and answers in their journals. 3. Student observe a teacher demonstration of the pH test and suggest an appropriate format for recording observations and interpretations. 4. In pairs, students carry out the pH test on a variety of materials that they have brought to class. 5. Students preview the relevant sections of their textbook. 6. Students observe a teacher demonstration of the procedure and method of recording observations for the natural indicators lab. 7. In pairs, students carry out the lab using some of the same materials as in the previous lab. They record observations and answer related textbook questions. 8. Students write individual journal entries in an imaginary role related to the activities of this lesson and formulate questions to extend their learning.

ONGOING ACTIVITIES Students will formulate their own questions related to the learning activities of the unit. They will participate in developing answers to these questions and will record both questions and answers in an ongoing journal.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 10 **Course** Science 14

CLASSROOM ORGANIZATION				STRANDS					
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING	PROGRAM OBJECTIVES*	MATERIALS
✓	✓		✓	✓	✓	✓	✓	Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 2, 3, 4, 5, 6, 8, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.2, 5.3 To practise appropriate previewing strategies when reading a text. To practise using written language for learning.	Chapter 4: "Acids and Bases" in G. Hutton, *Household Science*, Globe/Modern Curriculum Press. (Specific materials for this lab are listed in the lesson plan.) Table headed Investigating Acidic and Basic Household Substances, attached to the lesson plans. JOURNAL ENTRY for Chapter 4: Acids and Bases—Investigating Acidic and Basic Reactions in Common Household Substances, attached to the lesson plans. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape
✓	✓		✓	✓	✓	✓	✓	Specific Learner Expectations: Attitudes: 1 Skills: 1, 2, 3, 4, 6, 7, 8 Concepts: 2.3, 3.3, 5.2 To practise appropriate previewing strategies. To practise using written language for learning.	(Specific materials for the first lab are listed in the lesson plan.) Lab 10: "Natural Indicators" in *Applied Science I*, Copp Clark Pitman Ltd., pages 133–135. (Specific materials for this second lab are listed in the lesson plan.) JOURNAL ENTRY for Lab 10: Natural Indicators, attached to the lesson plans. OBSERVATION/PROFILE sheets designed for use with groups. Tape recorder Video camera Audiotape Videotape SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS

*SPECIFIC LEARNER EXPECTATIONS have been drawn from the Program of Studies for Science 14/24 as replicated in the Science 14/24 Teacher Resource Manual, pages 172 to 174. Other objectives have also been drawn from this source.

UNIT PLAN

THEME Household Science: Acids and Bases

FOCUS Acids and bases can be identified and their reactions observed in the home.

PROCESSES EXPLORING NARRATING IMAGINING EMPATHIZING ABSTRACTING MONITORING	DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
Lesson Five: Review Test and Homework Assignment Follow-Up ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson ✓ ✓ ✗ ✗ ✗ ✗	OBSERVATION and EVALUATION of selected students' learning and communication processes in their test answers, discussion, and journal writing.	1. Students write individual answers to questions selected by the teacher for the review test. 2. Students and teacher develop criteria for selecting the best journal entries from those written in response to the assignment for the previous lesson. 3. In small groups, students read, discuss, and select the best entry from a selection of journals. 4. The journal entries selected by students are shared with the class. The students explain how the selected journal entries meet the criteria established and suggest how they could be improved. 5. Students and teacher select questions from the journal entries to be answered. They participate in answering these questions, and record both questions and answers, individually, in their journals.
Lesson Six: General Properties of Acids and Bases ✗ indicates a process emphasized in the lesson ✓ indicates a process used in the lesson ✓ ✓ ✓ ✓ ✓ ✓	OBSERVATION and EVALUATION of selected students' reading, lab work, answers to questions, discussions, and journal writing.	1. Students review the expectations for their work indicated in the criteria and questions for self-evaluation. 2. Students preview the text and answer questions orally or in writing, individually or in pairs. 3. Students prepare a chart to record chemicals used and observations made as they carry out experiments. 4. In groups of two, students carry out the experiments, record chemicals used and observations, and prepare written answers for questions under "What Happened?" in the textbook. 5. Students complete the "Group Effectiveness Appraisal Form" to evaluate their work during this lab. 6. Students report on their observations during the experiments and share their answers to questions under "What Happened?" in the textbook. They might also report on problems they encountered in carrying out the experiments, how they solved these, and/or why they think they were unable to solve them. 7. Students suggest questions arising from these experiments and the discussion above, help to formulate answers, and record these in their journals.

ONGOING ACTIVITIES Students will formulate their own questions related to the learning activities of the unit. They will participate in developing answers to these questions and will record both questions and answers in an ongoing journal.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES

Grade 10 **Course** Science 14

CLASSROOM ORGANIZATION				STRANDS					
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING	PROGRAM OBJECTIVES*	MATERIALS
✓		✓	✓	✓	✓	✓		Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 2, 3, 4, 5, 6, 8, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.2, 5.3, 9.1, 9.2, 9.4 (The above will depend upon specific questions selected for the review test.) To apply appropriate criteria to "writing to learn"; to understand its purpose and value to their learning processes through the sharing, evaluation, and discussion of this writing. To practise using writing to learn.	Review test based on a selection of questions from those which students have helped to formulate and answer. Students' journals OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape
✓	✓		✓	✓	✓	✓	✓	Specific Learner Expectations: Attitudes: 1, 2, 4, 5 Skills: 1, 2, 3, 4, 6, 7, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.3 To practise appropriate prereading strategies. To practise self-evaluation of individual and group achievement in collaborative learning activities. To practise using oral and written language for learning.	Lab 10.6: "General properties of acids and bases" in *Applied Science I*, Copp Clark Pitman Ltd., pages 124–126. (Specific materials for this lab are listed in the lesson plan.) "Group Effectiveness Appraisal Form" in Science 14/24 Teacher Resource Manual, page 67. Tape recorder(s) Audiotape(s)

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UNIT PLAN

THEME Household Science: Acids and Bases

FOCUS Acids and bases can be identified and their reactions observed in the home.

PROCESSES							DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
	EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Seven: Culminating Activity — Alternative One (Poster) ✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson	✔	✔	✘	✘	✘	✘	OBSERVATION and EVALUATION of selected students' learning and communication processes as they draft, edit and proofread, and prepare final drafts of their work. CREATION OF INDIVIDUAL STUDENT PROFILES of learning and communication processes. CONFERENCING with individual students to share profiles and set goals to help them become independent learners.	1. Students write individual answers to questions selected by the teacher for the review test. 2. Students participate in prewriting activities to prepare them for the writing related to the poster assignment. 3. Individually or in pairs, students prepare a draft of the assignment. 4. Students edit and proofread each other's drafts and make suggestions for revisions and corrections. 5. Students evaluate the work of their peers. 6. Students publish and celebrate their work.

ONGOING ACTIVITIES Students will formulate their own questions related to the learning activities of the unit. They will participate in developing answers to these questions and will record both questions and answers in an ongoing journal.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 10 **Course** Science 14

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓	✓	✓	✓	✓	✓	✓	✓	Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 5, 11 Concepts: 2.1, 2.2, 2.3, 5.1, 5.3, 9.1, 9.2, 9.3, 9.4 (The above will depend upon specific questions selected for the review test.) To develop competencies in reading, writing, speaking, listening, and viewing. To develop the learning skills of finding, organizing, analysing, and applying information in a constructive manner. To acquire knowledge and develop skills, attitudes, and habits required to respond to the opportunities and expectations of the world of work. To practise appropriate prewriting strategies. To practise appropriate postwriting (editing and revising, proofreading, and correcting) strategies.	Review test based on a selection of questions from those that students have helped to formulate and answer. DESIGNING A POSTER TO PROMOTE SAFETY WITH ACIDS AND BASES, attached to the lesson plans. A variety of posters designed for audiences ranging in age from kindergarten children to adults. Any acceptable subject would be appropriate as examples. Students could be asked to provide some posters for discussion. Conventional HAZARD SYMBOLS, and other kinds of symbols, such as those found in airports, on laundry instructions, etc. would also be appropriate. Scrap paper—large size if possible. OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder(s) Audiotape(s) CRITERIA FOR EVALUATING POSTERS, attached to the lesson plans. Poster paper for final draft work. DESCRIPTIVE SCALES OBSERVATION/PROFILE SHEET for each student SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS SUMMARY AND GOALS FOR IMPROVEMENT completed by each student.

*SPECIFIC LEARNER EXPECTATIONS have been drawn from the Program of Studies for Science 14/24 as replicated in the Science 14/24 Teacher Resource Manual, pages 172 to 174. Other objectives have also been drawn from this source.

UNIT PLAN

THEME Household Science: Acids and Bases

FOCUS Acids and bases can be identified and their reactions observed in the home.

<table>
<tr><th colspan="6">PROCESSES</th><th rowspan="2">DIAGNOSTIC EVALUATION PROCEDURES</th><th rowspan="2">ACTIVITIES</th></tr>
<tr><th>EXPLORING</th><th>NARRATING</th><th>IMAGINING</th><th>EMPATHIZING</th><th>ABSTRACTING</th><th>MONITORING</th></tr>
<tr><td colspan="6">Lesson Seven: Culminating Activity – Alternative Two (Television Storyboard)</td><td rowspan="3">OBSERVATION and EVALUATION of selected students' learning and communication processes as they draft, edit and proofread, and prepare final drafts of their work.
CREATION OF INDIVIDUAL STUDENT PROFILES of learning and communication processes.
CONFERENCING with individual students to share profiles and set goals to help them become independent learners.</td><td rowspan="3">1. Students write individual answers to questions selected by the teacher for the review test.
2. Students participate in prewriting activities to prepare them for the writing related to the television storyboard assignment.
3. Individually or in pairs, students prepare a draft of the assignment.
4. Students edit and proofread each other's drafts and make suggestions for revisions and corrections.
5. Students evaluate the work of their peers.
6. Students publish and celebrate their work.</td></tr>
<tr><td colspan="6">✗ indicates a process emphasized in the lesson
✓ indicates a process used in the lesson</td></tr>
<tr><td>✓</td><td>✓</td><td>✗</td><td>✗</td><td>✗</td><td>✗</td></tr>
</table>

ONGOING ACTIVITIES Students will formulate their own questions related to the learning activities of the unit. They will participate in developing answers to these questions and will record both questions and answers in an ongoing journal.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 10 **Course** Science 14

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓	✓	✓	✓	✓	✓	✓	✓	Specific Learner Expectations: Attitudes: 1, 2, 4, 5 Skills: 5, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.3 (The above will depend upon specific questions selected for the review test.) To develop competencies in reading, writing, speaking, listening, and viewing. To develop the learning skills of finding, organizing, analysing, and applying information in a constructive manner. To acquire knowledge and develop skills, attitudes, and habits required to respond to the opportunities and expectations of the world of work. To practise appropriate prewriting strategies. To practise appropriate postwriting (editing and revising, proofreading, and correcting) strategies.	Review test based on a selection of questions from those which students have helped to formulate and answer. DESIGNING A TELEVISION AD TO HELP VIEWERS UNDERSTAND ACIDS AND BASES IN EVERYDAY ACTIVITIES, attached to the lesson plans. USING THE TELEVISION STORYBOARD FORMAT and the storyboard format on 8.5 x 14 inch paper, attached to the lesson plans. TERMS USED BY SCRIPTWRITERS AND CAMERA OPERATORS, attached to the lesson plans. Any promotional ad videotaped from television could be used as an example. Those promoting safe driving or a responsible approach to the consumption of alcohol might provide good models and serve a dual purpose. Conventional HAZARD SYMBOLS, and other kinds of symbols, such as those found in airports, on laundry instructions, etc., would also serve the purpose. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder(s) Audiotape(s) TELEVISION ADS: CRITERIA FOR EVALUATING STORYBOARDS, attached to the lesson plans. DESCRIPTIVE SCALES OBSERVATION/PROFILE SHEET for each student SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS SUMMARY AND GOALS FOR IMPROVEMENT completed by each student.

*SPECIFIC LEARNER EXPECTATIONS have been drawn from the Program of Studies for Science 14/24 as replicated in the Science 14/24 Teacher Resource Manual, pages 172 to 174. Other objectives have also been drawn from this source.

UNIT PLAN

THEME Household Science: Acids and Bases

FOCUS Acids and bases can be identified and their reactions observed in the home.

PROCESSES						DIAGNOSTIC EVALUATION PROCEDURES	ACTIVITIES
EXPLORING	NARRATING	IMAGINING	EMPATHIZING	ABSTRACTING	MONITORING		
Lesson Seven: Culminating Activity — Alternative Three (Library Research Project) ✘ indicates a process emphasized in the lesson ✔ indicates a process used in the lesson						OBSERVATION and EVALUATION of selected students' learning and communication processes as they draft, edit and proofread, and prepare final drafts of their work. CREATION OF INDIVIDUAL STUDENT PROFILES of learning and communication processes. CONFERENCING with individual students to share profiles and set goals to help them become independent learners.	1. Students write individual answers to questions selected by the teacher for the review test. 2. Students participate in prewriting activities to prepare them for the research and writing related to the assignment. 3. Individually or in pairs, students carry out the research and prepare a draft of the assignment. 4. Students edit and proofread each other's drafts and make suggestions for revisions and corrections. 5. Students evaluate the work of their peers. 6. Students publish and celebrate their work.
✔	✔	✘	✘	✘	✘		

ONGOING ACTIVITIES Students will formulate their own questions related to the learning activities of the unit. They will participate in developing answers to these questions and will record both questions and answers in an ongoing journal.

(EVALUATING STUDENTS' LEARNING AND COMMUNICATION PROCESSES)

Grade 10 **Course** Science 14

CLASSROOM ORGANIZATION				STRANDS				PROGRAM OBJECTIVES*	MATERIALS
INDIVIDUAL	PAIR	SMALL GROUP	WHOLE CLASS	READING	WRITING	ORAL COMM	VIEWING		
✓	✓	✓	✓	✓	✓	✓	✓	Specific Learner Expectations: Attitudes: 1, 2, 4, 5 Skills: 5, 6, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.3 (The above will depend upon specific questions selected for the review test and specific topics selected for library research projects.) To develop competencies in reading, writing, speaking, listening and viewing. To develop the learning skills of finding, organizing, analysing, and applying information in a constructive manner. To acquire knowledge and develop skills, attitudes, and habits required to respond to the opportunities and expectations of the world of work. (For other objectives, refer to relevant parts of the Science 14/24 Teacher Resource Manual, identified in the lesson plan.)	Review test based on a selection of questions from those that students have helped to formulate and answer. OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder (s) Audiotape (s) (For other materials, refer to the relevant parts of the Science 14/24 Teacher Resource Manual, identified in the lesson plan.) DESCRIPTIVE SCALES OBSERVATION/PROFILE SHEET for each student SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS SUMMARY AND GOALS FOR IMPROVEMENT completed by each student.

*SPECIFIC LEARNER EXPECTATIONS have been drawn from the Program of Studies for Science 14/24 as replicated in the Science 14/24 Teacher Resource Manual, pages 172 to 174. Other objectives have also been drawn from this source.

LESSON PLAN

Lesson One: Introduction

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To stimulate interest in the topic of this unit. To explore students' prior knowledge and experience related to the topic of this unit. Specific Learner Expectations: Attitudes: 2, 4 Skills: 11	Students speculate about possibilities (exploring relevant background knowledge, narrating stories seen, heard, or read, and perhaps imagining other possibilities).	As a prereading activity, ask students if they think it might be possible to destroy all traces of a body following a murder. After discussion, tell students that the article they will be reading recounts the story of a murderer who tried to do this.		"The Foul Case of the Acid Bath Murder," attached to these lessons.
To practise appropriate prereading strategies.		Assign students to groups of four for the postreading discussion. You will find it easier to make diagnostic evaluations of the students you have selected to focus on if you assign these students to the same group, use the observation/profile sheet designed for use with groups, and audiotape this group's discussion. These procedures will enable you to gather data and manage the class.		SMALL GROUP DISCUSSION QUESTIONS FOR "The Foul Case of the Acid Bath Murder," attached to these lessons. OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape
To practise small group discussion skills.	Students discuss and answer questions related to the article and to their own experiences.	Assign a group leader and a recorder in each group. Explain the roles of each in the discussion. Emphasize the importance of everyone participating to contribute to the group's learning.		

LESSON PLAN

Lesson One: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Make observations of selected students' learning and communication processes while the groups discuss and answer questions.		
	Group leaders present the group's responses to the discussion questions.	Direct class discussion. Encourage students to elaborate upon responses, ask questions of other groups, etc.		
To practise self-evaluation of individual and group achievement in small group activities.	Students complete self-evaluation of their participation in the small group discussion.	Explain the importance to the students themselves and to you as their teacher of self-evaluation of participation and achievements in small group discussions.		"Group Effectiveness Appraisal Form" in Science 14/24 Teacher Resource Manual, page 67. (You may wish to substitute the word "task" for "project" in numbers 1, 2 and 4 under "Personal assessment and observations.")
	To demonstrate the effect of an acid, put an animal bone in 6M HCl for a week. A student in a food preparation class might be asked to obtain the bone.			

LESSON PLAN

Lesson Two: Common Household Acids and Bases

Theme Household Science: Acids and Bases

Grade 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 6, 11 Concepts: 2.1, 5.1, 5.3, 9.1, 9.2, 9.4	Students suggest household materials that may contain acids and bases.	The transition to this lesson could be made by telling students that whereas the article read in Lesson One focuses on one acid used in an unusual situation, many common acids and bases can be found in their own homes. Ask the students if they can suggest some of these. List their suggestions on the chalkboard.		Article 10.2, "Common Sense with Acids and Bases" in *Applied Science I*, Copp Clark Pitman Ltd., pages 115–116.
To practise appropriate prereading strategies.		Article 10.2 can then be introduced as a source of information to extend their list of acids and bases found in the home. **Assign students to small groups of two or three, grouping those students together who have been selected for diagnostic evaluation. Use the observation/profile sheet designed for groups and audiotape this group's discussion as they answer the questions for Article 10.2.**	Students could view, discuss, and record ideas from a film dealing with the disposal of hazardous wastes, such as "Household Hazardous Waste Management," Edmonton: Abraxas, 1988.	**OBSERVATION/PROFILE sheet designed for use with groups.** **Tape recorder (s)** **Audiotape(s)**

LESSON PLAN

Lesson Two: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To practise small group discussion and collaborative learning skills.	Students work in small groups of two or three, discussing and preparing written answers to questions 1 to 5 on page 116.	Instruct the students to discuss answers and prepare one written copy of the answers for their group. These will be checked for satisfactory completion. Make diagnostic observations of selected students' level of independence in learning and communications processes as they discuss and answer the questions.		
	Students share group responses to the questions with the rest of the class.	Direct discussion.		
	An effective strategy to encourage students' active participation in their own learning and language development is to involve the students in formulating questions about what they are learning and in developing answers to those questions. The teacher then selects questions from those generated by the students to construct a weekly review test. (For examples of questions Science 14 students posed in relation to the learning activities in this unit, see *Handbook 1: Integrating Evaluation and Instruction.)* This activity could be introduced as a culmination to Lesson Two. The question types associated with Bloom's Taxonomy and with "quantity," "forecasting," and "point of view" questions (see Science 14/24 Teacher Resource Manual, pages 70 and 71) could be used as models to encourage students to formulate			

LESSON PLAN

Lesson Two: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	Students suggest questions and then select those for discussion and research.	Discuss the importance to science and to learning of posing questions to extend what is known and understood. Ask students to brainstorm a list of questions that might be asked on the basis of what they have learned in lessons One and Two. Have them select two to five questions they consider most important and interesting from the list generated. Discuss how these questions might be answered. (Some may be answered on the basis of what the group knows. Others may lead to special research activities or inquiry through experiments the students design and carry out.)		
To practise using written language to learn.	Students make individual records of questions and answers in their journals.	Following discussion, students should be asked to record the questions selected and keep a written account of their responses to these questions, in their own words, in a journal. This will enable students to use written language to learn (see Science 14/24 Teacher Resource Manual, page 21).		

LESSON PLAN

Lesson Two: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		It will also enable you to evaluate the students learning and communication processes. Through modelling, conferencing, and written responses to the students' journal writing, you can help students build on their strengths in the processes and address areas where they need to develop greater independence.		

LESSON PLAN

Lesson Three: Investigating Acidic and Basic Household Substances

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 2, 3, 4, 5, 6, 8, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.2, 5.3		To help students establish the connection between this lesson and the previous one, emphasizing the need for safe handling and storage of acids and bases, prepare two beakers, one containing salt and another containing sugar. Also prepare two solutions, one containing vinegar and the other ammonia.		Chapter 4: "Acids and Bases" in G. Hutton, *Household Science*, Globe/Modern Curriculum Press. 1 beaker containing sugar 1 beaker containing salt vinegar in solution ammonia in solution (N.B. ammonia is a strong base and will bleach the litmus white if it is in too strong a concentration) litmus paper distilled water baking soda cream of tartar sour milk citrus fruit juice scoops watch glasses
	Students suggest ways of testing to identify sugar and salt.	Show the students the beakers containing salt and sugar. Ask the students to suggest how they could test to find out which substance is sugar and which one is salt.		
		Show the students the two solutions containing vinegar and ammonia. Explain that one contains an acid and the other a base. Acids taste sour and bases taste bitter.		
	Students explain why a taste test would not be advisable to distinguish between acids and bases.	Ask the students if they would recommend the same kind of taste test to identify which solution contains an acid and which one a base. Why or why not?		

LESSON PLAN

Lesson Three: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Explain that scientists have devised a simple, safe test to distinguish between acids and bases. Explain how litmus paper is used as an indicator of acids and bases.		safety goggles
	Students observe the demonstration, discuss observations and interpretations, and record these on the table provided.	Distribute the table for recording observations and interpretations of the litmus test. Demonstrate how litmus paper can be used to identify the presence of an acid or a base in the vinegar and ammonia solutions. Discuss and have students record appropriate observations and conclusions.		Table headed Investigating Acidic and Basic Household Substances, attached to these lesson plans.
		The teacher should model the use of safety goggles during the demonstration, explaining why they must be worn during these investigations. (One teacher answers their protests this way: "Better ugly in the lab than in the lounge.")	Show and discuss a film emphasizing lab safety, such as: *Lab Safety: The Accident at Jefferson High* (VCR—18 minutes. Students demonstrate safety, proper use of equipment.) *Lab Safety: A Pratice for Life* Ross Haley STAO Promotions 73-1 Avenue N. Chesley, Ontario NOG 1L0 1-519-363-3359	

LESSON PLAN

Lesson Three: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To practise appropriate previewing strategies when reading a text.	Students suggest parts of the text to focus on in previewing the information, discuss the purpose of previewing the text, and predict outcomes of the investigations.	Preview the textbook chapter with the students (see Science 14/24 Teacher Resource Manual, page 77). Draw attention to the title, caution sign used to signal safety information, questions and illustrations accompanying the text, and the hazard symbol on page 30. Explain or elicit from students the purpose of previewing the text before beginning a closer reading. Students could be asked to predict the outcomes of some of the investigations they will carry out. Encourage the students to skim to get the gist of the text and to establish purposes for their reading by challenging them to suggest headings that the author might have used at the tops of pages 27, 28, and 29 to help the reader anticipate the information that follows. (e.g., "Testing for Acids and Bases," "Acid-base Reactions," "Using a pH Scale to Measure Acidity.")		

LESSON PLAN
Lesson Three: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	In groups of two, students carry out investigations D to J on pages 25 to 27 and record "observations" and "interpretations."	Instruct students to answer questions 4.4 to 4.8 in the appropriate spaces ("observations" and "interpretations") on the table provided.		
	In groups of two, students read the information and answer questions on pages 28 to 30.	After students have completed the investigations and cleaned up their lab stations, instruct them to discuss, in pairs, questions 4.9 to 4.18 and prepare one set of written answers to the questions. These can be checked for satisfactory completion.		
To practise using written language for learning.	Students write individual journal entries about the activities of the lesson and formulate questions to extend their learning.	To provide opportunity for students to use language for learning to reflect on what they have learned during this lesson and to pose questions for further learning, ask them to make an entry in their journals about this lesson. Specific suggestions and questions to focus their thinking and writing are attached to these lessons.	If the students have had a great deal of experience with journal writing, the teacher may prefer to make the assignment more open-ended, letting students determine what to write. Another approach might be to ask them to write about the activities of the lesson in such a way that someone who was absent might readily understand what they did and what they learned.	JOURNAL ENTRY for Chapter 4: Acids and Bases—Investigating Acidic and Basic Household Substances, attached to these lesson plans.

LESSON PLAN

Lesson Three: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		The journal entries of the students selected for diagnostic evaluation can be examined for evidence of their learning and communication processes in learning and communication processes. The journal entries of all students can be examined for indications of problems in understanding that need to be addressed to ensure learning. The journals will also provide a source of questions to add to those generated in Lesson Two.		
	Homework Assignment Ask the students to bring to class some common, safe household materials that may be acids or bases (e.g., foods, lotions, beverages, cosmetics, shampoos). Caution them that alcohol-based materials are not acids or bases and will dissolve the indicator, turning it white.			

LESSON PLAN

Lesson Four: Testing Acids and Bases Using pH Meter/Paper and Natural Indicators

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1 Skills: 1, 2, 3, 4, 6, 7, 8 Concepts: 2.3, 3.3, 5.2	Selected students read their journal entries.	Review the previous lesson by having a few students read their journal entries. To clarify expectations for this writing, the teacher could preselect a few entries that would provide good models for other students and point out the strengths of each in their use of the six learning and communication processes of the ESLCP.		Students will provide some common household materials containing acids and bases. The teacher will provide others such as coke, fruit juice, milk, antacid, water, tea, and some of the more potentially hazardous materials such as drain cleaner and H_2SO_4 pH meter and/or pH paper
	Students participate in selecting questions and formulating answers and record these in their journals.	Select two or three of the most productive questions students posed at the end of their journal entries and discuss answers to these questions.		
		Remind students that they have previously learned how to use a simple test to determine if a substance is an acid or a base. They also know that scientists indicate the strength of an acid or a base using a pH scale. Today they will learn two methods of measuring the strength of an acid or a base, first using a pH meter (or paper), and then using natural indicators occurring in common plants.	Ideas for simple activities with acids and bases can be found in the Teacher Resource for *Concepts and Challenges in Science: Book 2*, pages 106 to 125.	

LESSON PLAN

Lesson Four: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	Students observe and suggest an appropriate format for recording observations and interpretations.	Demonstrate the pH test, using a variety of materials. Ask students to suggest a format for recording observations and interpretations.		
	Working in pairs, students carry out the pH test on materials they have brought from home.	Group students selected for diagnostic evaluation together. Audiotape their discussion(s). Using the OBSERVATION/PROFILE sheet designed for groups, record observations and evaluations of their learning and communication processes.		OBSERVATION/PROFILE sheet designed for use with groups Tape recorders(s) Audiotape(s)
To practise appropriate previewing strategies.	Students preview the text, report what they have examined in their preview, explain the purpose of the lab and procedures to be followed, and predict the outcomes of their investigations.	Review procedure for previewing a text. Ask the students to preview Lab 10: Natural Indicators. Ask them what they examined in their preview. Ask them to explain what they have learned about what they will be doing in this lab, what materials they will be testing, how they will record their results, and what they might anticipate from previewing the questions on page 135. What step will they omit?		Lab 10: Natural Indicators in *Applied Science I*, Copp Clark Pitman Ltd., pages 133 to 135. safety goggles plastic spot plates coloured crayons solutions of pH2, pH4, pH6, pH8, pH10, pH12 in dropper bottles

LESSON PLAN

Lesson Four: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	**PROCEDURES**			**MATERIALS**
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Demonstrate the procedure and the method of recording observations for this lab.		Natural indicators such as tea, beet juice, etc. (Some materials used in the preceding lab can be used again.)
	Working in the same pairs, students prepare a chart following the example on page 134, carry out the lab using some of the same materials used in the preceding lab, record observations, and answer questions under "What Happened?" on page 135.	As time permits, record periodic observations and evaluations of the students' learning and communication processes.		
To practise using written language for learning.	Homework Assignment Vary the journal writing assignment by asking students to take on an imaginary role (see RAFTS in Science 14/24 Teacher Resource Manual, pages 81 to 83), such as that of the scientist who might have discovered natural indicators. The responses of students selected for diagnostic evaluation can be assessed in terms of strengths and weaknesses evident in the six learning and communication processes of the ESLCP.			JOURNAL ENTRY for Lab 10: Natural Indicators, attached to these lessons.

LESSON PLAN

Lesson Four: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Ask the students selected for diagnostic evaluation to review samples of some of their work done up to this point and complete a self-evaluation of their learning and communication processes. If time permits, you may be able to conduct individual conferences with these students. This will enable you to share your evaluations with the students, compare your evaluations with their self- and peer evaluations, and begin to set goals to help them develop more independence in the six processes.	Ask each student to select a classmate who will examine the same data and do a peer evaluation of his or her learning and communication processes.	SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS

LESSON PLAN

Lesson Five: Review Test and Homework Assignment Follow-Up

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 2, 3, 4, 5, 6, 8, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.2, 5.3, 9.1, 9.2, 9.4 (The above will depend upon specific questions selected for the review test.)	Working independently, students write answers to questions selected for the review test.	Discuss the purpose of the review test, specify criteria to be used in evaluating students' answers, and give any other instructions necessary.		Review test based on a selection of questions from those which students have helped to formulate and answers.
		Explain that students will be working in groups of four. They will read the journal entries of their group members for Lab 10: Natural Indicators and then select one journal entry they consider the best from their group. This will be read (anonymously) to the class.	If students are very reticent about sharing their own work, distribute the journals so that they are reading other group's journals.	Students' journals
To apply appropriate criteria to "writing to learn"; to understand its purpose and value to their learning processes through the sharing, evaluation and discussion of this writing.	Students participate in establishing appropriate criteria for evaluating the journal entries.	Guide students in developing the criteria for selecting the best journal entry (e.g., Complete—the writer deals with all parts of the assignment in a thorough manner. Imaginative—the writer has taken some calculated risks, trying out original ideas; the writer shows an understanding of and an appreciation for the work of scientists. Authentic, realistic—the writer takes a serious approach to the task; the writer has taken on the		

LESSON PLAN

Lesson Five: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		role and created a definite voice in the writing). Note: Because this is "writing to learn," criteria applicable to final products (spelling, grammar, sentence structure) should not be emphasized here. Ask the students to be prepared to point out how the criteria established for selection are evident in the entry they select. They should also be prepared to say how the writing could be improved to meet any of the criteria more effectively.		
	In groups of four, students read their journal entries and select the one that best meets the criteria. One of the students (or the teacher) reads the selected entry to the class. The members of the group explain how this entry meets the criteria and how it could be improved to do so more effectively.	Group together students selected for diagnostic evaluation and audiotape their discussion. Record observations and evaluations of their learning and communication processes.		OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder Audiotape
		Model appropriate positive, constructive comments for the students. Point out, too, examples of effective use of the six learning and communication processes in the students' journal entries.		

LESSON PLAN

Lesson Five: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		Ask questions to provoke further thought and discussion about what the students have written.		
To practise using writing to learn.	Students select questions from their group's journals, participate in the selection of questions to be answered by the class, participate in answering those questions, and record questions and answers in their journals.	Ask students to select two questions from the journal entries for discussion by the class.	Vary the procedure by giving each group responsibility for developing preliminary answers (through discussion and further research if necessary) to some of the questions. Give them the responsibility of explaining their answers to the class.	

LESSON PLAN

Lesson Six: General Properties of Acids and Bases

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1, 2, 4, 5 Skills: 1, 2, 3, 4, 6, 7, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.3		To relate this lesson to previous lessons, remind students that they have previously learned how to test acids and bases in a variety of ways. In today's lab, they will be investigating the chemical activity of acids and bases.	If it is difficult to collect the hydrogen gas for the first experiment, try corking the test tubes to capture the gas. As an alternative, add several pieces of Zn to 20 ml of HCL in a 50 ml beaker. This generates more hydrogen gas and because the beaker has a wider mouth, the glowing splint can be brought closer to the gas to produce the appropriate reaction.	Lab 10.6: General properties of acids and bases in *Applied Science I*, Copp Clark Pitman Ltd., pages 124 to 126. safety goggles 3 test tubes test tube rack baking soda (sodium bicarbonate) mossy zinc 3 mol/L sodium hydroxide solution filtered limewater marble chips (calcium carbonate) ammonium chloride solution long glass dropper aluminum pieces 3 mol/L hydrochloric acid
	Students review the expectations for their work indicated in the criteria and questions for self-evaluation.	To encourage students to take a serious approach to the task and to monitor their work during this lab, inform them that they will be completing a self-evaluation of the effectiveness of their work. Distribute the "Group Effectiveness Appraisal Form" so that students can review the criteria and questions before they begin work.		
To practise appropriate prereading strategies.	Students preview the text and answer questions orally or in writing, individually or in pairs.	Direct the students to preview the text before they begin the lab. Probe their understanding through questions: What parts of the text have they examined? How many experiments are there in this lab? How are these indicated for the reader?	Because students have had previous opportunities to practise previewing a text, you might ask for written answers to these questions and mark them as part of the students' summative evaluation for this unit.	

LESSON PLAN

Lesson Six: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		What specific safety precautions must be taken in this lab? What do they predict they will observe in each experiment? What specific clues in the text, diagrams, and questions helped them form these predictions?		sodium hydroxide pellets red and blue litmus paper wooden splints scoopula
	Student prepare a chart to record chemicals used and observations made as they carry out experiments.	Instruct the students to prepare a chart for recording chemicals used and observations, following the example on page 124 of the text.	Responsibility for carrying out the experiments and reporting to the rest of the class might be divided up among the students (e.g., half the class, working in groups of two, does experiments I and II; the other half, working in groups of two, does experiments III and IV). Their report to the class might involve a demonstration by one pair and should include a description of the chemicals used, the procedures followed, the observations made, and a discussion of the practical application (or implications) of the reaction produced. As well, students could be asked to report any problems they	"Group Effectiveness Appraisal Form" in Science 14/24 Teacher Resource Manual, page 67. (You may wish to substitute the word "lab" for "project" in numbers 1, 2, and 4 under "Personal Assessment and Observations.")
	In groups of two, students carry out the experiments, record chemicals used and observations, and prepare written answers for questions under "What Happened?" in the textbook.	Assign students to groups of two. Place students selected for diagnostic evaluation in the same group(s). Audiotape their discussion as they carry out the lab. Because the potential safety hazards in this lab will require close monitoring of students' work, diagnostic evaluation of students' learning and communication processes might best be done at a later time, using the audiotaped data collected.		Tape recorder(s) Audiotape(s)

LESSON PLAN

Lesson Six: (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To practise self-evaluation of individual and group achievement in collaborative learning activities.	Students complete the "Group Effectiveness Appraisal Form" to evaluate their work during this lab.		encountered in carrying out the experiment, how they solved these, or why they think they were unable to solve them. This procedure would give time for students to repeat an experiment if it does not work on the first try and would provide opportunity for them to practise clear, concise communication for a real audience.	
	Students report on their observations during the experiments and share their answers to questions under "What Happened?" in the textbook. They might also report on problems they encountered in carrying out the experiments, how they solved these, and/or why they think they were unable to solve them.	Facilitate discussion, encouraging students to relate their observations to other contexts at home or in their work place. Note any questions students raise as potential contributions to the ongoing activity of formulating questions and answers.		
To practise using oral and written language for learning.	Students suggest questions arising from these experiments and the discussion above, help to formulate answers, and record these in their journals.	Assist students in selecting and answering questions.		

LESSON PLAN

Lesson Seven: Culminating Activities – A Note on the Alternatives Proposed

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

Three alternatives are proposed as a culminating activity for this unit. Alternatives ONE (poster) and TWO (television storyboard) will require less time than THREE (library research project). The latter might be done as part of the elective component of the course.

All the alternatives will involve students in applying their knowledge of acids and bases to the creation of an original communication for a definite audience. Whereas the previous writing assignments (the journal entries) were intended to provide opportunities for students to use writing for learning, the culminating activities will require the students to shape their language, gradually, towards a final product intended for a public audience. Because the goal is a polished final product, the students will need time and guidance to work through the three stages of the writing process (prewriting, writing, and postwriting) described in the Science 14/24 Teacher Resource Manual on page 79.

For alternatives ONE (poster) and TWO (television storyboard), specific activities for the three stages in the writing process and evaluation criteria for marking the students' final products are provided in the lesson plans. For alternative THREE (library research project), specific activities for the three stages in the writing process and evaluation criteria are provided in the Science 14/24 Teacher Resource Manual on pages 91 to 109 and 157.

LESSON PLAN

Lesson Seven: Culminating Activity – Alternative One (Poster)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1, 2, 4 Skills: 5, 11 Concepts: 2.1, 2.2, 2.3, 5.1, 5.3, 9.1, 9.2, 9.3, 9.4	Working independently, students write answers to questions selected for the review test.	Discuss the purpose of the review test, specify criteria to be used in evaluating students' answers, and give any other instructions necessary.	The review test might be given here or at another point while the culminating activity is in progress.	Review test based on a selection of questions from those that students have helped to formulate and answer.
Other SPECIFIC LEARNER EXPECTATIONS will depend upon specific questions selected for the review test. To develop competencies in reading, writing, speaking, listening, and viewing.		Introduce the poster assignment by telling students that they will be designing a poster to promote safety with acids and bases. They will be using what they know to help other people become better informed about safety precautions. Distribute the assignment sheet and draw attention to the fact that the students' final products will be "published"—displayed where they will serve to inform the intended audience.	If the school has a science fair or an open house for the community, the posters could be displayed for these events, too.	DESIGNING A POSTER TO PROMOTE SAFETY WITH ACIDS AND BASES, attached to these lesson plans.
To develop the learning skills of finding, organizing, analysing, and applying information in a constructive manner.		The following prewriting activities (see Science 14/24 Teacher Resource Manual, page 79) will help students prepare for the writing.		
To acquire knowledge and develop skills, attitudes, and habits required to respond to the opportunities and expectations of the world of work.	Students suggest ideas and possible methods of developing the posters.	1) Brainstorm ideas that could be used for each of the assignment choices. Encourage students to explore the ways that		

LESSON PLAN

Lesson Seven (Poster): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To practise appropriate prewriting strategies.		they might develop a poster based on these ideas. Encourage risk-taking (e.g., a humorous approach could have considerable impact).		
	Students identify and discuss verbal and nonverbal techniques used in a variety of posters.	2) Use examples of other posters to show how illustrations, symbols, logos and color are used to convey the message. Examine how language (including slogans) is used in a poster. Compare the different ways in which language is used for different audiences. Discuss how the designer creates a balance that is pleasing to the eye. Students could be asked to examine these aspects of different posters in small groups and explain to the class how these techniques have been used.	Collaboration with an art teacher and/or an English language arts teacher might be possible here.	A variety of posters designed for audiences ranging in age from kindergarten children to adults. Any acceptable subject would be appropriate as examples. Students could be asked to provide some posters for discussion.
	Students suggest possible symbols, logos and slogans for their posters. They examine conventional symbols and derive criteria for effective design.	3) Brainstorm ideas for symbols, logos and slogans that might be used in the students' own posters. Examine conventional		Conventional HAZARD SYMBOLS and other kinds of symbols, such as those found in airports, on laundry

LESSON PLAN

Lesson Seven (Poster): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		hazard symbols to derive criteria for effective design (simplicity, use of readily understood graphics, contrast, colour, etc.) They might consider how these could be improved to communicate their message more effectively. Emphasize that these are examples to give students some ideas for designing their own original symbols.		instructions, etc., would also be appropriate.
	Working individually or with a partner, students plan and prepare a draft of their poster.	The students could work individually or with a partner to promote collaborative learning. You may wish to encourage students selected for diagnostic evaluation to work together. Audiotape their discussions as they work and collect all drafts of their work for later evaluation of their learning and communication processes. You may also be able to conference with the students while they are in the process of completing the assignment.		Scrap paper—large size if possible. OBSERVATION/PROFILE sheet designed for use with groups (or individuals). Tape recorder(s) Audiotape(s)
To practise appropriate postwriting (editing and revising, proofreading and correcting) strategies.	Students edit and proofread each other's drafts and make specific suggestions for revisions and corrections.	After the students have completed a draft of the poster, have them exchange drafts with another individual or pair to edit and proofread		

LESSON PLAN

Lesson Seven (Poster): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		each other's drafts. Introduce the evaluation criteria as a basis for editing and proofreading. Students should make specific suggestions for revisions and corrections.		CRITERIA FOR EVALUATING POSTERS, attached to these lesson plans. (Note that marks for each of the five criteria have been left to the teacher's decision.)
	Students evaluate the work of their peers.	After the final drafts have been completed, peer evaluation and feedback, based on the criteria for evaluation, could be used to complement teacher evaluation.		Poster paper for final draft work.
	Students publish and celebrate their work.	Arrange for the posters to be displayed for their intended audiences.		
		For each of the students selected for diagnostic evaluation, construct a profile showing how independently he or she can use the six learning and communication processes. Ask the students to create profiles for themselves based on their self and peer evaluations. Use the profiles to set goals and plan instructional activities for the next unit of work to help the students become more independent in		DESCRIPTIVE SCALES OBSERVATION/PROFILE SHEET for each student. SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS

LESSON PLAN

Lesson Seven (Poster): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		their use of the learning and communication processes.		

LESSON PLAN

Lesson Seven: Culminating Activity – Alternative Two (Television Storyboard)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1, 2, 4, 5 Skills: 5, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.3 Other SPECIFIC LEARNER EXPECTATIONS will depend upon specific questions selected for the review test. To develop competencies in reading, writing, speaking, listening, and viewing. To develop the learning skills of finding, organizing, analysing, and applying information in a constructive manner. To acquire knowledge and develop skills, attitudes, and habits required to respond to the opportunities and expectations of the world of work.	Working independently, students write answers to questions selected for the review test.	Discuss the purpose of the review test, specify criteria to be used in evaluating students' answers, and give any other instructions necessary. Introduce the television storyboard assignment by telling the students that they will be assuming the roles of television script writers who have been hired to create a one-minute ad for a new television science program. The purpose of the ad is to inform the viewers about acids and bases in everyday activities in the home or work place. Tell the students that they will learn how to use a storyboard to design a television ad. Distribute the description of the assignment. Draw attention to the choices (A and B) and ask students to read the assignment sheet. The following prewriting activities (see Science 14/24 Teacher Resource Manual, page 79) will help students prepare for the writing.	The review test might be given here or at another point while the culminating activity is in progress.	Review test based on a selection of questions from those that students have helped to formulate and answer. DESIGNING A TELEVISION AD TO HELP VIEWERS UNDERSTAND ACIDS AND BASES IN EVERYDAY ACTIVITIES, attached to these lesson plans.

LESSON PLAN

Lesson Seven (Television Storyboard): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
To practise appropriate prewriting strategies.	Students suggest products that could be used for the assignments and discuss possible ways of developing the ads.	1) Brainstorm a list of products that could be used for each of the assignments (A and B). Encourage students to explore the ways they might develop a television ad around some of the products listed. Encourage risk-taking (e.g., a humorous approach may have a considerable impact).		
		2) Explain how the storyboard format is used. Draw attention to the three different audiences for this writing and how language must be adapted for each of these audiences.		USING THE TELEVISION STORYBOARD FORMAT and the storyboard format on 8.5 x 14 inch paper, attached to these lesson plans.
		3) Explain terms used to describe camera shots.		TERMS USED BY SCRIPTWRITERS AND CAMERA OPERATORS, attached to these lesson plans.
	Students identify and discuss the effectiveness of verbal and nonverbal techniques used in a promotional ad.	4) Use a videotaped promotional ad from television to provide specific examples of the various camera shots, the "voice over" technique, the use of background music and sound effects, and the use of symbols, logos, and		Any promotional ad videotaped from television could be used as an example. Those promoting safe driving or a responsible

LESSON PLAN

Lesson Seven (Television Storyboard): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		slogans to make the message memorable. Ask different groups of students within the class to watch and listen for these techniques and comment on how they are used in the ad.		approach to the consumption of alcohol might provide good models and serve a dual purpose. **However, please note that you must obtain permission to use copyrighted material.**
	Students suggest possibilities for symbols, logos, and slogans for their ads. They examine conventional symbols and derive criteria for effective design.	5) Brainstorm ideas for symbols, logos and slogans that might be used in the students' own ads. Examine conventional hazard symbols to derive criteria for effective design (simplicity, use of readily understood graphics, contrast, colour, etc.). They might consider how these could be improved to communicate their message more effectively. Emphasize that these are examples to give students some ideas for designing their own original symbols.		Conventional HAZARD SYMBOLS and other kinds of symbols, such as those found in airports, on laundry instructions, etc. would also serve the purpose.
		The students should work in groups of two or three to promote collaborative learning. You may wish to assign students selected		

LESSON PLAN

Lesson Seven (Television Storyboard): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		for diagnostic evaluation to the same group.		
		Audiotape their discussions as they work and collect all drafts of their written work for later evaluation of their learning and communication processes. You may also be able to conference with the students while they are in the process of completing the assignment.		OBSERVATION/PROFILE sheet designed for use with groups. Tape recorder(s) Audiotape(s)
To practise appropriate postwriting (editing and revising, proofreading, and correcting) strategies.	Working in groups of two or three, students plan and prepare a draft of the assignment. Students edit and proofread each other's drafts and make specific suggestions for revisions and corrections.	After students have completed a draft of the assignment, have them exchange drafts with another group and edit and proofread each other's work. Introduce the evaluation criteria as a basis for editing and proofreading. Students should make specific suggestions for revisions and corrections.		TELEVISION ADS: CRITERIA FOR EVALUATING STORYBOARDS, attached to these lesson plans. (Note that marks for each of the five criteria have been left to the teacher's decision.)
	Students publish and celebrate their work through presentation to the class. They evaluate the work of their peers.	After the final drafts have been completed, students could present their finished products to the class. Peer evaluation and feedback, based on the criteria for evaluation, could be used to complement teacher evaluation.	Students may wish to draw pictures to illustrate some or all of the camera shots in their storyboard. It may be possible to produce a videotape based on the students' storyboards. A cooperative venture with the drama teacher, the media club, the	

LESSON PLAN

Lesson Seven (Television Storyboard): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
		For each of the students selected for diagnostic evaluation, construct a profile showing how independently he or she can use the six learning and communication processes. Ask the students to create profiles for themselves based on their self- and peer evaluations. Use the profiles to set goals and plan instructional activities for the next unit of work to help the students become more independent in their use of the learning and communication processes.	graphic arts teacher, or the English language arts teacher might lead to the wider publication and celebration of students' work.	DESCRIPTIVE SCALES OBSERVATION/PROFILE SHEET for each student SELF-EVALUATION PROFILE SHEETS PEER EVALUATION PROFILE SHEETS

LESSON PLAN

Lesson Seven: Culminating Activity – Alternative Three (Library Research Project)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
Specific Learner Expectations: Attitudes: 1, 2, 4, 5 Skills: 5, 6, 11 Concepts: 2.1, 2.2, 2.3, 2.4, 5.1, 5.3	Working independently, students write answers to questions selected for the review test.	Discuss the purpose of the review test, specify criteria to be used in evaluating students' answers, and give any other instructions necessary.	The review test might be given here or at another point while the culminating activity is in progress.	Review test based on a selection of questions from those that students have helped to formulate and answer.
Other SPECIFIC LEARNER EXPECTATIONS will depend upon specific questions selected for the review test and specific topics selected for library research projects. To develop competences in reading, writing, speaking, listening, and viewing. To develop the learning skills of finding, organizing, analyzing, and applying information in a constructive manner. To acquire knowledge and develop skills, attitudes, and habits required to respond to the opportunities and expectations of the world of work.	For the library research project, students might investigate the application of acids and bases in some of the following topics: • acid rain • acids/antacids • auto body acid wash • forensic medicine • furniture refinishing • galvanizing • industry • L.S.D. • medicine • natural indicators • pH balance in shampoos It would be most helpful to plan this project in collaboration with your school's teacher-librarian, who can assist you in setting objectives appropriate to the needs of your students, in identifying and collecting suitable resources, and in teaching library research skills. For further information to assist you in planning a library research project, consult the Science 14/24 Teacher Resource Manual, pages 91 to 109. There you will find specific suggestions for organizing, implementing, managing, and evaluating a library research project for Science 14 students.		To help students establish a purpose for their research, the topics might be cast in the form of RAFTS (see Science 14/24 Teacher Resource Manual, pages 81 to 83). For example: in the role of a furniture refinisher, write a column for newspaper readers explaining the role of acids and bases in furniture refinishing.	

LESSON PLAN

Lesson Seven (Library Research Project): (Cont'd)

Theme Household Science: Acids and Bases **Grade** 10 **Course** Science 14

OBJECTIVES	PROCEDURES			MATERIALS
	STUDENT ACTIVITY	TEACHER ACTIVITY	SUPPLEMENTARY OR ALTERNATE PROCEDURES	
	If an oral presentation is to be part of the project, you will find evaluation criteria suggested in the Science 14/24 Teacher Resource Manual on page 157.			
		You may wish to encourage students selected for diagnostic evaluation to work together. Audiotape their discussions as they work and collect all drafts of their work for diagnostic purposes. You may also be able to conference with the students while they are in the process of completing the assignment.		OBSERVATION/PROFILE sheet designed for use with groups (or individuals) Tape recorder(s) Audiotape(s)
		Construct a profile of strengths and weaknesses in learning and communication processes for each student selected for diagnostic evaluation. Invite self-evaluation by each student and share the results of your diagnostic evaluation with them. Use the profiles to plan appropriate follow-up instructional activities for these students.		

Student Materials

The Foul Case of the Acid Bath Murder[1]

This chapter has dealt with sulphur and sulphuric acid. You already know how to make salts by the action of acids on metals or carbonates. This section deals with a man who made some complex salts by using concentrated sulphuric acid, to react with a more valuable material than either metals or carbonates. He paid a very high price for doing so . . . his life . . .

The year is 1949. The scene is the County Court, Lewes where John George Haigh is being tried for murder. There is a big crowd (mainly of women) outside the courtroom, for this case has caught the horrified imagination of the British Public. This is not altogether surprising—because John George Haigh has admitted to murder, but at the same time, claims that no charges can be brought against him! He maintains that if no trace of the body can be found, then there can be no charge. There is no trace of the body, because it has been dissolved in sulphuric acid . . .

Unpaid bill

The story begins in South Kensington, in a hotel which was the home of two elderly, respectable ladies—Mrs. Lane, and her friend, Mrs. Durand-Deacon. A middle-aged businessman, whose business he would only very vaguely describe, also lived there: his name was John Haigh. The management was becoming increasingly interested in the subject of his business, because his bill had not been paid for some time, and it was growing large.

One day, Mrs. Durand-Deacon disappeared. Mrs. Lane, beginning to growing anxious, started to make a few enquiries around the hotel. Mr. Haigh quickly appeared and expressed concern, too. Mrs. Lane and Mr. Haigh agreed to go the police, for Mr. Haigh had some information that suggested there was cause for concern.

As he told police, he had been trying to interest Mrs. Deacon in a business venture which would manufacture "stick-on" plastic fingernails. They had driven into London, where he had stopped to do some shopping. She had not returned to their arranged meeting spot, and so after awhile, he had returned to the hotel without her.

Criminal record

For a while, the police worked on this information, but they could find no further clues to suggest what had happened to her. Enquiries were made into Mr. Haigh's background, and it turned out that he had been in prison twice before, on charges of forgery and fraud. The police were now suspicious. Mr. Haigh was interviewed again; a cleaner's receipt in his possession led them to a shop where they found Mrs. Deacon's fur coat, being cleaned. Haigh was arrested. He then made a statement, which, when published, shocked Britain.

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[1] ©Oxford University Press 1978. Reproduced from *Chemistry Matters* by Richrd Hart (1978) by permission of Oxford University Press.

Evidence "disappeared"

The police inspector questioning him had no idea that he would make the following statement.

"If I tell you the truth, you would not believe it; it sounds too fantastic for belief . . ." At this point, he was cautioned again. But he went on.

"I will tell you all about it. Mrs. Durand-Deacon no longer exists. She has disappeared completely and no trace of her can ever be found again."

"I have destroyed her with acid. You will find the sludge that remains at Leopold Road. Every trace has gone. How can you prove murder if there is no body?"

But Haigh was wrong on two counts. Firstly, murder *can* be proven if no trace of the body exists. Secondly, it was not the case that the body had been completely dissolved. Some traces did remain . . .

Forensic science team called in

This was a job for the forensic science team, and it was quite a job that they had to do. The police had uncovered some hundredweights of greasy sludge, and they now had the task of working out whether these were the remains of a human person.

Sulphuric acid had been used. You will have been warned in the lab to quickly wash off any spillages. The acid will react with flesh. Bones are tougher, being a mixture of organic and inorganic compounds—but both will dissolve eventually. There are few things that will *not* react with concentrated acid to produce either a simple or a complex salt.

But some things will not—and they provided a major source of evidence against Haigh. The handle of a red plastic bag and a plastic denture—both of which had belonged to Mrs. Deacon—remained intact and identifiable. The police could even work out that she had suffered from a gall bladder complaint . . .

Haigh pays the price

Haigh realized that the evidence against him was very serious indeed. Having made the statement mentioned above, he then began a string of increasingly bizarre statements hoping to make people believe that he was insane. If this could be demonstrated, then instead of being hung, he would be committed (for life) to Broadmoor Prison. He even asked the inspector in charge of his case:

"Has anyone ever been released from Broadmoor?"

The inspector replied, "Before you start worrying how to get out of Broadmoor, start worrying how you get in!"

A leading Harley Street doctor examined him, and became convinced that Haigh was insane. He spoke in Haigh's defence at his trial.

But the jury was not convinced. It took them only fifteen minutes to come to their verdict, "Guilty." He was hanged seventeen days later at Wandsworth prison. Haigh paid the price for performing what must be the most gruesome experiment to produce salts, of all time.

SMALL GROUP DISCUSSION QUESTIONS
for The Foul Case of the Acid Bath Murder

Group members: Leader ____________ ____________

Recorder ____________ ____________

1. Skim through the last part of the article again and make a list of the things that were **dissolved** by the acid.

2. Next, make a list of the things that were **not dissolved by the acid.**

3. What would you have done to dispose of this evidence? Try to think of several possible ways to do this.

4. Tell about a personal experience you have had handling acids around your home, school, or workplace.

5. Can you suggest a container that could be used to store acids safely?

INVESTIGATING ACIDIC AND BASIC HOUSEHOLD SUBSTANCES

NAME ____________________

Substance	Test	Observations	Interpretations
vinegar	blue litmus		
vinegar	red litmus		
ammonia	blue litmus		
ammonia	red litmus		
distilled water	blue litmus		
distilled water	red litmus		
baking soda	blue litmus		
baking soda	red litmus		
cream of tartar	blue litmus		
cream of tartar	red litmus		
sour milk	blue litmus		
sour milk	red litmus		
fruit juice	blue litmus		
fruit juice	red litmus		

JOURNAL ENTRY
for

Chapter 4: Acids and Bases—Investigating Acidic and Basic Reactions in Common Household Substances

Writing in your journal about what you have done during your classes will help you to understand and remember what you have learned and how you have learned it. It will also help you to think of questions you can ask to learn and understand more about this unit and about how scientists think and work. Overall, it will help you improve your learning, thinking, and writing.

The following questions and suggestions will help you think of what to write in your journal about today's class.

- Write what you have learned today about these things:

  —safety procedures in the lab
  —how to safely identify acids and bases
  —the importance of keeping a written record of observations and interpretations when you carry out scientific investigations
  —the value of previewing the information in your textbook
  —how you can use your knowledge of acid-base reactions at home or in your workplace

- Did you and your partner encounter any problems as you carried out your work today? Why do you think this happened? Were you able to solve these problems?

- Think about what you read and the work you did today and compose at least two questions that you would like to have answered so that you can learn more about acids and bases **or** about the information in your textbook **or** about how scientists work.

JOURNAL ENTRY
for

Lab 10: Natural Indicators

This journal entry will be a little different from the one you did previously. This time you will be taking on an imaginary role and writing as if you were someone else. The following instructions will give you some ideas for your writing. However, you will also have an opportunity to use your imagination.

> Imagine that you are the scientist who discovered that natural indicators could be used to measure the strength of acids and bases. Naturally, you are very excited about this important discovery and you want to make a permanent record of it. In your journal entry, recount how you made this discovery. What made you suspect that indicators might occur naturally in plants? Was it an accidental discovery? How did you test your assumptions? What did you observe? Explain why you think this is an important and useful discovery. What questions has it raised that you will want to pursue in subsequent investigations?

DESIGNING A POSTER
TO PROMOTE SAFETY WITH ACIDS AND BASES

For this assignment you will be designing a poster to promote the safe handling, use, and/or storage of acids and bases. Your poster will be displayed in one of the school's labs or in the community, depending upon the assignment you select from the choices below.

CHOOSE **ONE** OF THE FOLLOWING ASSIGNMENTS

A. Design a poster for use in **a school lab**. Your poster should inform **other students** about the safety precautions they should take in the lab when they are handling and using acids and bases. To help your audience remember your message, create an **original** hazard symbol, logo, or slogan, appropriate for the purpose of the poster.

B. Design a poster for use in **a school lab**. Your poster should inform **other students** about how acids and bases may be safely stored and disposed of in the lab. To help your audience remember your message, create an **original** hazard symbol, logo, or slogan, appropriate for the purpose of the poster.

C. Design a poster for use in **a school lab**. Your poster should inform **other students** about how to properly treat an acid or a base spill. Emphasize the materials that should be used for neutralizing either type of spill. To help your audience remember your message, create an **original** hazard symbol, logo, or slogan, appropriate for the purpose of the poster.

D. Design a poster for use in **a workplace where people handle, use, and store materials containing acids or bases** as part of their work. Your poster should inform **the workers** how to safely handle, use, and store materials containing acids and bases in their workplace. To help your audience remember your message, create an **original** hazard symbol, logo, or slogan, appropriate for the purpose of the poster.

E. Design a poster for display in **a day-care centre, supermarket,** or **pharmacy**. Your poster should inform **the parents of small children** how to safely store acids and bases in their homes. To help your audience remember your message, create an **original** hazard symbol, logo, or slogan, appropriate for the purpose of the poster.

F. Design a poster for display in **a day-care centre** or **a kindergarten** classroom. Your poster should inform **preschool children** about the dangers of eating or drinking substances that may contain acids or bases. To help your audience remember your message, create an **original** hazard symbol, logo, or slogan, appropriate for the purpose of the poster.

CRITERIA FOR EVALUATING POSTERS

Name(s) of the poster designer(s) ____________________ ____________________

The poster demonstrates a clear understanding and an accurate application of safety precautions related to the handling, use, and/or storage of materials containing acids and bases.	
The language used is appropriate to the intended audience. It communicates clearly, precisely, and concisely.	
The poster makes effective use of illustrations and color to catch the interest of the audience and to convey the information. It is neat, visually appealiing, and easy to read.	
The poster makes effective use of an original hazard symbol, logo, or slogan to help the audience remember the message.	
The conventions of language (spelling, punctuation, and grammar) are accurate.	

TOTAL

DESIGNING A TELEVISION AD TO HELP VIEWERS UNDERSTAND ACIDS AND BASES IN EVERYDAY ACTIVITIES

For this assignment, the members of your group will take on the roles of **television scriptwriters** who have been hired by the producers of a television science program. The producers have asked you to create a **one-minute television ad** that will help their viewers become better informed about how **acids and bases** are involved in **everyday activities**. They have given you a choice of two specific assignments, described below. You will use a television storyboard to design your ad.

CHOOSE **ONE** OF THE FOLLOWING ASSIGNMENTS

A. Using a television storybook format, design a one-minute television ad to promote the **safe use and storage** of a product containing acid or a base. (Think about what you have learned in this unit and select an appropriate product.) In your ad, show the viewers what can happen if this product is used or stored in a **dangerous** manner. Then show them how to use and store the product **safely**. To help your viewers remember your message, design a **hazard symbol** for this product that will remind them of the danger, and use it in your ad.

B. Using a television storyboard format, design a one-minute television ad to promote a better understanding of how an acid-base reaction can be used to **solve a common household problem**. (Think about what you have learned in this unit and select an appropriate problem.) Show your viewers what can happen if a person **does not understand** how an acid-base reaction is related to the problem. Then show them how a knowledge of the acid-base reaction can help them **deal more effectively** with the problem. To help your viewers remember your message, create a **logo** or a **slogan** that will remind them of the solution to the problem, and use it in your ad.

USING THE TELEVISION STORYBOARD FORMAT

The television screen is used to describe what the viewer will see on the television screen. The **audience** for this writing is the **camera operator**; therefore, some special terms that have meaning for scriptwriters and camera operators are used here.

V.O. is an abbreviation for "voice over." In this space, the scriptwriter writes what the viewers will be hearing while they are watching the picture on the screen. The **audience** for this writing is the **viewers** who are watching the program; therefore, the language used has to be very clear, precise, and concise in order to communicate ideas quickly to people who may not know much about your topic. The scriptwriter must be able to put complex ideas into simple terms for viewers.

B/G is an abbreviation for "background." In this space, the scriptwriter describes any background music or sounds that will be used continuously, under the announcer's voice, during this camera shot. The **audience** for this writing is the **sound operator**; therefore, the description must be brief and clear.

EFFECTS is a short form of "sound effects." In this space, the scriptwriter describes any special sound effects that will be used during this camera shot and where they will be used. The **audience** for this writing is the **sound operator**; therefore, the description must be brief and clear.

TERMS USED BY SCRIPTWRITERS AND CAMERA OPERATORS

To describe the **distance** between the camera and the subject:

LS—"long shot", of a person's whole body, for example
  —often used at the beginning of a sequence to set the scene for viewers

MS—"medium shot", of the upper part of a person's body, for example

CU—"close up", of a person's face, for example
  —often used to emphasize special information or symbols

To describe **camera movement**:

PAN—left/right/up/down

ZOOM—in/out

To describe **camera angle**:

TILT—up/down

To describe **transitions** from one shot to another:

CUT

FADE IN/FADE OUT

PROJECT TITLE: ____________________

DIRECTOR/COORDINATOR: ____________________ (TOTAL TIME: min) PAGE ________

SCRIPTWRITER: ____________________

V.O.	V.O.	V.O.
B/G:	B/G:	B/G:
EFFECTS:	EFFECTS:	EFFECTS:

TELEVISION ADS: CRITERIA FOR EVALUATING STORYBOARDS

Names of the scriptwriters: ____________________ ____________________

The ad demostrates a clear understanding and an accurate application of scientific ideas and language related to acids and bases.	
The language used communicates clearly, precisely, and concisely to each of the three audiences (camera operator, viewers, sound operators).	
The ad makes effective use of visuals, camera shots (distance, movement, angle, transition), background music, and sound effects to reinforce the verbal message.	
The ad make effective use of an original symbol, logo, or slogan to help the viewer remember the message.	
The conventions of language (spelling, punctuation, grammar) are accurate.	
TOTAL	